MAY 16 1921

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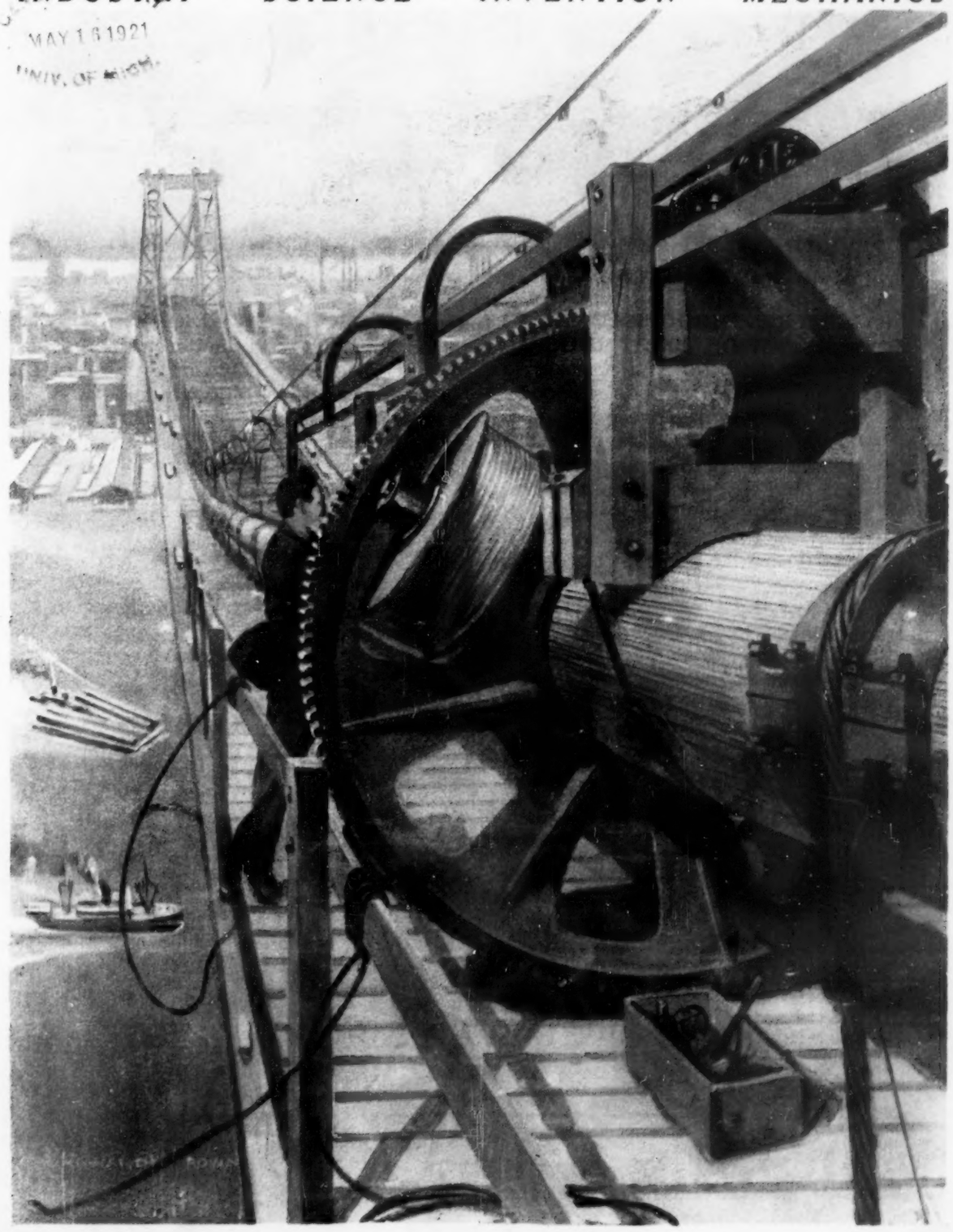
KEEPING OUR RAILROADS UP TO THE MARK
FIXED STARS THAT ARE NOT FIXED

SCIENTIFIC AMERICAN

A Weekly Review of Progress in

INDUSTRY · SCIENCE · INVENTION · MECHANICS

MAY 16 1921
UNIV. OF MICH.



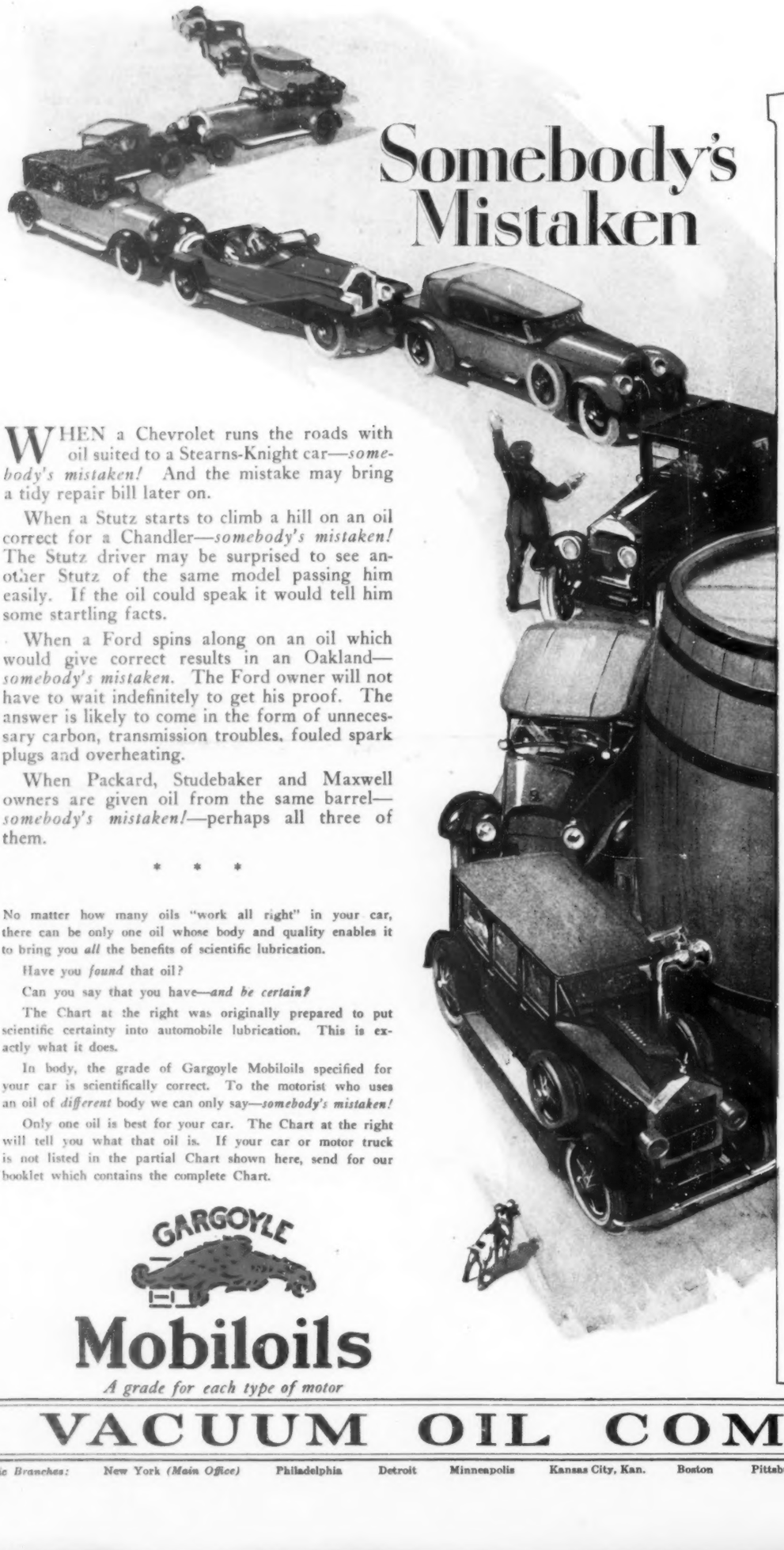
WINDING THE WIRE WRAPPING ON THE CABLES OF A SUSPENSION BRIDGE.—[See page 391]

Vol. CXXIV. No. 20
May 14, 1921

Published Weekly by
Scientific American Publishing Co.
Munn & Co., New York, N. Y.

Price 15 Cents
20 cents in Canada

Somebody's Mistaken



WHEN a Chevrolet runs the roads with oil suited to a Stearns-Knight car—*somebody's mistaken!* And the mistake may bring a tidy repair bill later on.

When a Stutz starts to climb a hill on an oil correct for a Chandler—*somebody's mistaken!* The Stutz driver may be surprised to see another Stutz of the same model passing him easily. If the oil could speak it would tell him some startling facts.

When a Ford spins along on an oil which would give correct results in an Oakland—*somebody's mistaken.* The Ford owner will not have to wait indefinitely to get his proof. The answer is likely to come in the form of unnecessary carbon, transmission troubles, fouled spark plugs and overheating.

When Packard, Studebaker and Maxwell owners are given oil from the same barrel—*somebody's mistaken!*—perhaps all three of them.

* * *

No matter how many oils "work all right" in your car, there can be only one oil whose body and quality enables it to bring you *all* the benefits of scientific lubrication.

Have you *found* that oil?

Can you say that you have—*and be certain?*

The Chart at the right was originally prepared to put scientific certainty into automobile lubrication. This is exactly what it does.

In body, the grade of Gargoyle Mobiloils specified for your car is scientifically correct. To the motorist who uses an oil of *different* body we can only say—*somebody's mistaken!*

Only one oil is best for your car. The Chart at the right will tell you what that oil is. If your car or motor truck is not listed in the partial Chart shown here, send for our booklet which contains the complete Chart.

GARGOYLE

Mobiloils

A grade for each type of motor

Chart of Recommendations
for AUTOMOBILES
(Abbreviated Edition)

GARGOYLE

Mobiloils

A grade for each type of motor

How to Read the Chart

THE Correct Grades of Gargoyle Mobiloils for engine lubrication are specified in the Chart below.

A means Gargoyle Mobiloil "A"
B means Gargoyle Mobiloil "B"
E means Gargoyle Mobiloil "E"
Arc means Gargoyle Mobiloil Arctic

These recommendations cover all models of both passenger and commercial vehicles unless otherwise specified.

Where different grades of Gargoyle Mobiloils are recommended for summer and winter use, the winter recommendation should be followed during the entire period when freezing temperatures may be experienced.

This Chart is compiled by the Vacuum Oil Company's Board of Automotive Engineers, and constitutes a scientific guide to Correct Automobile Lubrication.

If your car is not listed in this partial chart, consult the Chart of Recommendations at your dealer's, or send for booklet, "Correct Lubrication," which lists the Correct Grades for *all* cars.

NAMES OF AUTOMOBILES AND MOTOR TRUCKS	1920		1919		1918		1917		1916	
	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter
Acason (2 ton)	A	Arc	A	A	A	Arc	A	Arc	A	Arc.
" All Other Models	A	Arc	A	Arc	A	Arc	A	Arc	A	Arc.
Allen	A	Arc	A	Arc	A	Arc	A	Arc	A	Arc.
Apperson (8 cylinder)	A	A	A	A	A	A	A	A	A	A
" All Other Models					A	A	Arc	Arc	Arc	Arc.
Atterbury (Model 6-E)	A	A	A	A						
" All Other Models	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc.
Autocar (2 cylinder)	A	A	A	A	A	A	A	A	A	A
Buck	Arc.	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc.
Buessen (4 cylinder)	A	Arc	A	Arc	A	Arc	A	Arc	A	A
" (8 cylinder)									A	A
Buick	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc.
Cadillac	A	A	A	A	A	A	A	A	A	A
Chalmers (6-48)									Arc	Arc
" (6-40)									A	Arc.
" All Other Models	A	A	A	A	A	A	A	A	A	A
Chandler Six	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc.
Chevrolet (4 cylinder)			A	A	A	A	A	A		
" (F. A.)			A	Arc	A	Arc				
" (F. B. and 1 ton)	A	Arc								
" All Other Models	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc.
Cleveland	A	Arc								
Columbia (Detroit)	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc		
Cunningham	A	A	A	A	A	A	A	A	A	A
D-E (1¼ and 2½ ton)	A	Arc	A	Arc	A	Arc	A	Arc		
" (5 ton)	A	A	A	A	A	A				
" All Other Models	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc		
Dodge Brothers	A	Arc	A	Arc	A	Arc	A	Arc	A	Arc
Essex	A	Arc	A	Arc						
Federal (Model 5-3C)					A	A	A	A		
(Special)					Arc	Arc				
" All Other Models	Arc	Arc	Arc	Arc	A	A	Arc	Arc	Arc	Arc
Ford	E	E	E	E	E	E	E	E	E	E
Franklin	A	A	A	A	A	A	A	A	A	A
Gramm-Bernstein (5 ton)	A	A	A	A	Arc	A	Arc	Arc		
" All Other Models	Arc	Arc	A	Arc	A	Arc	A	Arc	A	Arc.
Grant (6 cylinder)	A	Arc	A	Arc	A	Arc	A	Arc	A	Arc.
" (Cont'l) (Model 12)			A	Arc						
" (") All Other Models	Arc	Arc	Arc	Arc						
Haynes (6 cylinder)	A	Arc	A	Arc	A	Arc	A	Arc	A	Arc.
(12 cylinder)	A	A	A	A	A	A	A	A	A	A
Holmes	B	A								
Hudson Super Six	A	Arc	A	Arc	A	Arc	A	Arc	A	A
" All Other Models									Arc	Arc.
Hupmobile	A	Arc	A	Arc	A	Arc	A	Arc	A	A
Jordan	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc		
Kelly Springfield	A	A	A	A	A	A	A	A	A	A
King (8 cylinder)	A	A	A	A	A	A	A	A	A	A
Kissel Kar (Model 6B)									A	A
" (12 cylinder)					A	A	A	A		
" All Other Models	A	Arc	A	Arc	A	Arc	A	Arc	A	Arc
Koehler (Model H)	A	A	A	A						
" All Other Models	A	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
Liberty	A	A	Arc	Arc	Arc	Arc	Arc	Arc		
Locomobile	A	F	A	E	E	E	E	E	E	E
Madison (6 cylinder)			A	Arc	A	Arc	A	Arc	A	Arc
" (8 cylinder)							A	A	A	A
Marmon	A	A	A	A	A	A	A	A	A	A
Maxwell	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
Mercer	A	A	A	A	A	A	A	A	A	A
M. H. M.	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc		
Mitchell (6 cylinder)	A	Arc	A	Arc	A	Arc	A	Arc	A	Arc
" (8 cylinder)									A	A
Moline-Knight			B	A	B	A	A	A	A	A
Nash (Quad)	A	A	A	A	A	A				
" (Model 671)					A	A				
" All Other Models	A	Arc	A	Arc	A	Arc				
National (6 cylinder)	A	A	Arc	Arc	Arc	Arc	Arc	Arc	A	Arc
" (12 cylinder)			A	A	A	A	A	A	A	A
Nelson	A	A	A	A	A	A	A	A	A	A
Oakland (8 cylinder)									A	A
" All Other Models	A	A	A	A	A	A	Arc	Arc	Arc	Arc
Oldsmobile (4 cylinder)	A	Arc	A	Arc					Arc	Arc
" (6 cylinder)	A	A	A	A	A	A	Arc	Arc		
" (8 cylinder)	A	A	A	A	A	A	A	A	A	A
Overland	A	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
Packard	A	A	A	A	A	A	A	A	A	A
Paige (6 cylinder)	A	Arc	A	Arc	A	Arc	A	Arc	A	Arc
" (Cont. Eng.)	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
" All Other Models	A	A								
Paterson	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
Peerless (8 cylinder)	A	A	A	A	A	A	A	A	A	A
" All Other Models					Arc	Arc	Arc	Arc	Arc	Arc
Pierce Arrow	A	A	A	A	A	A	A	A	A	A
" (Cont'l) (5 ton)	A	A	A	A	Arc	Arc	Arc	Arc	Arc	Arc
" (") All Other Models	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
Premier	A	A	A	A	A	A	A	A	A	Arc
R. & V. Knight	B	A								
Reo	A	Arc	A	Arc	A	Arc	A	Arc	A	Arc.
ReVere	A	A	A	A	A	Arc				
Riker	A	E	A	E	A	E	E	E		
Rock Falls	A	A	A	Arc						
Saxon			E	E	E	E	E	E	E	E
Sayers Six	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc		
Sayers & Scoville (5 & 5)	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
Scripps-Booth (4 cylinder)					Arc	Arc	A	Arc	A	A
(6 & 8 cylinder)	A	A	A	A	A	A	A	A	A	A
Selden (¾ ton)							A	Arc		
" (5 ton)	A	A	Arc	Arc	Arc	Arc				
" All Other Models	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
Service (120-130-140-170-220)	A	Arc	A	Arc	A	Arc	A	Arc	A	Arc
" All Other Models	A	A	A	A	A	A	A	A	A	A
Stearns-Knight	B	A	B	A	B	A	A	A	B	A
Studebaker	A	A	A	A	A	Arc	A	A	A	Arc
Stutz	A	A	A	A	A	A	A	A	A	A
Templar	A	A	A	A	A	A				
Velie (Model 34)	A	Arc								
" (6 cylinder)	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc.
" (Cont'l) (¾ ton)			A	Arc	A	Arc				
" (") All Other Models	Arc	Arc	Arc	Arc	Arc	Arc				
Westcott	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc.
White (16 valve)			A	A	A	A	A	A		
" (5 ton)			A	Arc	A	Arc				
" All Other Models			Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc.
Willys-Knight	B	A	B	A	B	A	B	A	B	A
Willys Six	A	Arc	Arc	Arc	Arc	Arc	Arc	Arc		
Winton	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc.

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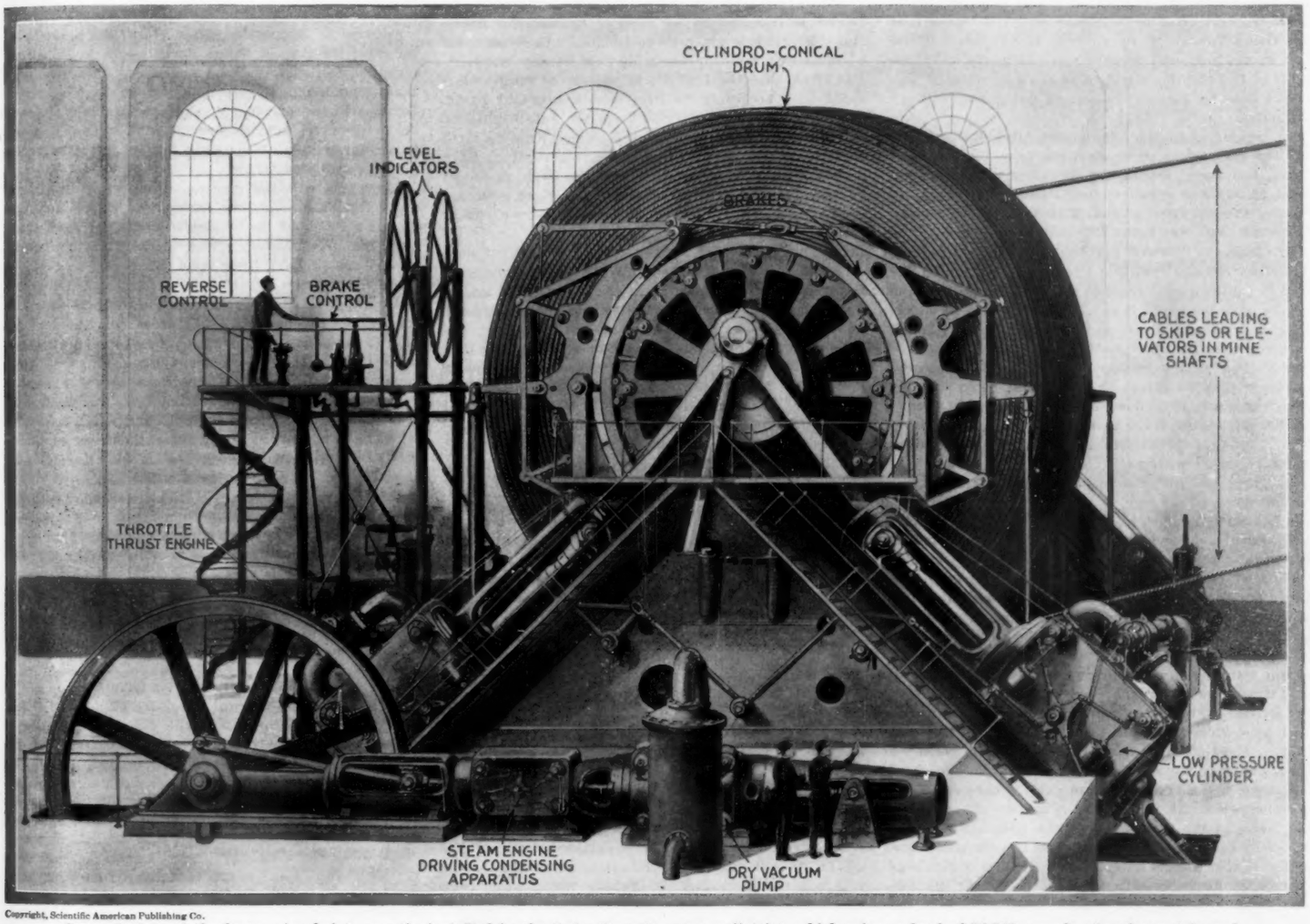
SEVENTY-SEVENTH YEAR

SCIENTIFIC AMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

VOLUME CXXIV.] NUMBER 20] NEW YORK, MAY 14, 1921 [15 CENTS A COPY 20 CENTS IN CANADA



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General view of the huge mine hoist recently installed in the Lake Superior copper district, which raises a load of 20,000 pounds of rock per trip and handles 10,000 feet of rope

A Giant Among Mine Hoists

WHAT is believed to be the largest hoist in the world—and by a good margin—has recently been installed in the Lake Superior copper district. This mine hoist, which has been drawn up from the constructor's blue-prints by our artist, has a winding capacity of 10,000 feet of 1⅝-inch rope reaching down an inclined shaft to a vertical depth of 6,600 feet. When winding the rope down the second cone of the drum, it has a capacity of 13,300 feet, reaching to a vertical depth of 8,600 feet. The hoist operates in balance, raising a load of 20,000 pounds of rock per trip and designed for a rope speed of 3,200 feet per minute.

The giant mine hoist is a cross-compound engine having two high-pressure and two low-pressure Corliss cylinders. Each cylinder is arranged on an individual frame and with its cross-head, connecting rod and piston rods, forms an engine, each engine being arranged to drive the drum shaft above it. These engines are mounted on a triangular frame at the apex of which the main drum shaft is located. Each engine is set at 45 deg. of the vertical and so arranged that two low-pressure cylinders are connected to one crank pin while both high-pressure cylinders are connected to the other crank pin. The low-pressure pistons are supported by the cross-head and tail guides. The low-pressure and high-pressure cylinders are provided with separate throttle valves, the high-pressure having a balanced poppet type valve, while the low-pressure has a rocking valve.

The drum of this huge hoist is of the cylindro-conical type which is so familiar in the Lake Superior copper district. There being eight impulses per revolution, together with the great mass of the drum, which weighs 516,000 pounds without the shaft, all pulsation in the rope is eliminated. The drum is built up of 48 sections securely bolted together and thoroughly trussed. This arrangement prevents all deflection of the drum shaft.

The hoist is fully protected by an improved safety stop, whereby the throttle valve is automatically closed as the skip approaches the landing. In case of over winding, the brakes are applied automatically, and the control is so arranged that the hoist cannot be started in the wrong direction by the operator. Overspeed is prevented by a speed governor which controls the cut-off cams of the valve gear.

At each end of the drum is a set of ingenious brakes, 16 feet in diameter, each one actuated by an oil cylinder which takes its oil from a loaded accumulator. The oil cylinders are controlled by special poppet valves, one controlling the lift and the other the drop of the piston, and so arranged that both valves cannot be opened at the same time. The reverse mechanism and the throttle are handled in the same way.

The total weight of the engine with the condensing equipment is 1,767,000 pounds. The engine covers a floor space of 60 feet by 54 feet and stands 60 feet high from the bottom of the foundation to the top of the drum. The foundation under the hoist and condensing equipment contains 3,000 yards of concrete.

THE SCIENTIFIC AMERICAN, May 14, 1921. Volume 124, Number 20. Published weekly by Scientific American Publishing Company at 233 Broadway, New York, N. Y. Subscription price, $6.00 per year.
Entered as second-class matter June 18, 1879, at the post office at New York, N. Y., under the act of March 3, 1879.

SCIENTIFIC AMERICAN

Published by Scientific American Publishing Co.
Founded 1845
New York, Saturday, May 14, 1921
Munn & Co., 233 Broadway, New York

Charles Allen Munn, President; Orson D. Munn, Treasurer
Allan C. Hoffman, Secretary; all at 233 Broadway

Entered at the Post Office of New York, N. Y., as Second Class matter. Trade Mark Registered in the United States Patent Office.

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Who Is Delaying Disarmament?

THERE can be no question whatever that the country at large was dumbfounded to learn, as it did a few months ago, that over ninety per cent of the current national expenditures are to cover the cost of wars that have occurred in the past and that may occur in the future. It was this material fact as much as, and perhaps more than, the moral aspects of the question that produced the practically universal demand for a reduction of naval and military estimates.

In response to the taxpayers, the Government, through its various representatives from the President down, has stated during the past few weeks that we must at any cost complete the three-year program, including the six ships of the "Indiana" class, although these last will cost about 250 million dollars. At the same time, in answer to the widespread desire of American citizens that our President should take the lead in calling a conference to discuss disarmament, the people have been told that we cannot afford to undertake disarmament alone, and that the President must be given time for due consideration of this matter before calling such a conference. Meanwhile, Congress is voting that we spend about 400 million dollars, for this year alone, upon our Navy.

The astounding thing about the statement that we cannot consent to disarm until other naval powers agree to do so with us is, that the only other naval power that has hitherto surpassed us in strength not only commenced disarmament more than two years ago, but has carried the thing to such an extent that, first: it is questionable whether today she equals us in the power of her first fighting line; second: it is certain that if we complete our three-year program in its entirety our Navy will exceed the British Navy in capital strength by at least thirty per cent; and third: if we also round out our Navy, which will be a comparatively inexpensive thing to do, we shall exceed that Navy in actual material strength by at least fifty per cent.

Startling facts, but true; for we must remember that the British first-line ships are obsolescent today, being with one exception from five to nine years old, and that by the time the seventeen capital ships which we have under construction are completed, the finest of her ships, will be from eight to twelve years old. The question which we wish to ask Congress on behalf of the people of the United States who wish for economy, is: Why is it that, in making these Government statements that we must go slowly in calling for a conference of disarmament, no acknowledgment whatsoever is made of the fact that the biggest navy in the world has already made this enormous stride in this very direction? Surely this is a fact pregnant with meaning, upon which the people of America have a perfect right to be informed.

That we are not unduly stressing a minor point, but that we are laying our hand upon a most significant and elemental fact, is proved by the reply to a question raised in the British House of Commons on April 13th as to the number of vessels that had been removed from the naval lists of Japan, the United States and Great Britain since the armistice. The Parliamentary Secretary to the Admiralty said that the phrase "removed from the naval list" had been taken to mean scrapped; and on this basis the figures are as follows: Japan has scrapped two light cruisers and four destroyers; the United States has scrapped five battleships of the pre-dreadnaught class, one cruiser, three light cruisers, twenty-one destroyers and fourteen submarines; and the British Empire has scrapped thirty-eight battleships of the dreadnaught and pre-dreadnaught type, two battle-cruisers, eighty-seven cruisers, three hundred destroyers, including flotilla leaders, and one hundred and six submarines.

With such evidence of good faith before us, why do we hesitate to call a conference for the mutual adjustment of naval strength and the all-round reduction of naval and military financial burdens?

The Anti-Einstein Campaign

THE intellectual world moves slowly in the matter of extending recognition to those who have consecrated their lives to the cause of reason. Mendel had been dead many years before the remarkable nature of his work was recognized. When we contrast Mendel's case with that of Einstein we are forced to admit that the German physicist's sensational rise is the most extraordinary in the history of science. Barnum, king of advertisers, could not have staged a more effective or expeditious advertising campaign."

With so much of Professor Reuterdahl's article in the *Dearborn Independent* we suppose anyone will agree. But this article is given its real place by the scare-head of the cover, which asks, in ¾-inch letters, "IS EINSTEIN A PLAGIARIST?" It will be at once understood that according to Professor Reuterdahl he is. We expect this sort of thing from the anti-Semites of Germany, and from those of the former Kaiser's loyal supporters who resent Dr. Einstein's refusal to have anything to do with the celebrated Manifesto of the 93 Immortals. But from a reputable American source—even one celebrated for its anti-Semitism—we should look for something a little different.

It is not easy for a layman to form a just estimate of Einstein's work. And whatever temptation to error is presented to him will be in the direction of underestimation. The phrase "relativity of motion" is not new. The Greeks had it, Newton had it, every popular explanation of Einstein starts by reminding us that this is something we have always known but chosen to ignore. It is easy to overlook that Einstein has taken this familiar notion, applied it with a rigor and a consistency and a generality which it has never before enjoyed, given it a significance and got results out of it which it had never before been dreamed lay in it.

Again with the problem of gravitation. We all know that Newton solved this problem empirically only. We all know that he said nothing about the causes or the mechanism of gravitation—for the excellent reason that he could learn nothing of these. We all know that since his time thousands of scientists have searched for the cause and the mechanism. We do not all know what is equally true, that many of these searchers have been led to propose slight modifications in Newton's mathematical law—modifications which were in agreement with this or that observed fact.

All this makes it very easy to accuse Einstein of plagiarism. Not alone is everyone acquainted with classical relativity apt to judge the contents by the label on the container and assume that Einstein's relativity is the same old stuff, but the claim may with some show of plausibility be made that any investigator of gravitation has anticipated Einstein. This claim gains color in the far-from-rare case that its beneficiary can be shown to have attained results which are included in Einstein's, or to have supplied Einstein with some of his material. Nobody would claim that Einstein's entire structure is novel—the sum total of human knowledge is today too large to make it possible for a contribution like his to be made out of whole cloth.

Everyone who possesses enough mathematics to follow Einstein knows that he has made a very material original contribution—that he has formulated mathematically and as a concrete whole ideas which have had a rather nebulous existence before him, cementing the structure with ideas to which he has himself given birth. His crowning achievement is the precise mathematical formulation; this has never been approached or approximated in any way.

We can paraphrase Professor Reuterdahl with some profit. Never in the history of science has anyone ever made an epoch-marking advance, but what the vultures have flocked about his trail, demanding credit for what he has done and claiming ownership of the work which he has put out. But never before has it been the case that the really big men of science have accepted an advance so promptly and so whole-heartedly, and left this business of picking the bones to the small fry whose names will be forgotten fifty years from now.

The Re-Birth of the Port of New York

ON Saturday, April the 30th, there was signed without ceremony or flourish of trumpets at the Chamber of Commerce, this city, a document wihch marks the rebirth of the Port of New York. It constitutes a compact by which the states of New York and New Jersey pledged themselves to close coöperation in the future planning of the Port of New York.

In the previous history of the Port its development has been retarded by the existence of a geographical boundary line, on each side of which state and municipal jealousies and suspicions have been rife, with the result that it has been impossible to secure that coöperation which wide-visioned men among us for many, many years past have recognized as being absolutely necessary to the coordinated development of the Port. The compact which has now been ratified recognizes that the interests of the Port of New York, whether they lie to the east or the west of the Hudson River, should be considered as inseparable. Henceforth the planning of the Port, in respect to its docks, piers and railroad terminal facilities, will be under the authority of a joint commission, in which both New York and New Jersey will be represented, and whose single aim will be to promote, not the special interests of any one particular section of the Port, but its interests as one great coordinated whole.

Not alone will the creation of the Port Authority affect New York and New Jersey, but its influence will be felt throughout the whole of the United States, and more remotely in every corner of the world that sends or receives shipping to or from this port. In this connection, Governor Miller of New York stated that the work which this Port Authority has to do is second in importance to none. "In its future consequences not only to the people within what we call the port district, but as well to the entire commerce and industry of the country, it will exceed in importance any single enterprise or undertaking that we know of." Doubtless he had in mind the high terminal charges at this port, which affect every shipper from the interior whose goods have to pass through New York. Incidentally, the fact was brought out in a homely but very telling fashion in a motion picture which was shown at the Chamber of Commerce gathering, in which the journey of a "Mr. Potato" was traced from his birthplace in Michigan to the ultimate consumer in the Bronx. The cost of moving this gentleman from the breaking up point on the arrival of his train on the Jersey meadows to the market place in the Bronx was shown to be greater than the cost of the whole freight trip from Michigan to New Jersey.

Death of Dr. W. R. Brooks

WE are sorry to record the death of our old friend and contributor, Dr. W. R. Brooks, Professor of Astronomy at Hobart College and the recognized discoverer of more comets (27 in all) than any living astronomer, a record only surpassed by a French astronomer, Pons, who had 28 to his credit. Dr. Brooks was born in England in 1844, made his first telescope when he was 14 years of age, and though it was a crude affair, he was able to view Donati's great comet of 1858. At 17 years of age he delivered his first astronomical lecture with charts which he made himself. As a young man he was employed in iron works in Buffalo, where he acquired mechanical skill which enabled him to make his own astronomical instruments, for it is an interesting fact that most of his discoveries were made with a telescope of his own construction. On the completion of his third instrument, in 1881, he discovered his first comet. He constructed a temporary observatory at Phelps, N. Y., where he discovered 11 comets. In 1888 he moved to Geneva, N. Y., to take charge of Smith Observatory, and it was here that he discovered 16 comets, the last one being on October 21, 1912. Perhaps Dr. Brooks's greatest achievement was in 1883, when he caught the first glimpse of the returning comet of 1812 which was discovered by Pons. Although astronomers all over the world were looking for its return they were all disappointed except the silent observer at the Red House Observatory with his home-made instrument. Dr. Brooks in his long life was the recipient of the highest astronomical honors.

Dr. Brooks wrote astronomical notes for the SCIENTIFIC AMERICAN for many years and this journal usually had the first publication of his great discoveries.

Science

"Elinvar."—This is a new alloy discovered by Guillaume, the inventor of "Invar," and is said to be an improvement over that alloy, as it is more uniformly elastic.

Books and Trees.— An average spruce tree when converted into paper yields about 500 pounds of that product. If a novel runs to 300,000 copies, the destruction of trees would be 600.

Another Medal for Mme. Curie.—The gold medal of the National Institute of Social Sciences will be given to Mme. Curie on May 19th in New York. The following day she will receive her gram of radium at the hand of President Harding. A Pittsburgh concern has received the contract for the radium. Three bids were tendered but the prices quoted are not disclosed.

Paris Landlords Ban Radium Investigators.—Paris landlords who have leased apartments and offices to doctors who use radium have decided that they will no longer rent out space to them as they think that the emanations are a menace to the health of other tenants. This was all brought about by radium scientists who stated that the doctors' rooms should be lined with lead. This has naturally had its effect on timid patients and fees have dropped off.

The Coliseum Loses Its Movies.—A week or so ago we chronicled the fact that the Flavian amphitheater, or Coliseum in Rome had been leased to a company of moving picture producers. There was so much opposition to the scheme from all over the world that the project has been abandoned. Italy may need money, for she has always been the Cinderella of Europe, but her antiquities and works of art are her big asset and anything which tends to hurt them will hurt her financially.

Germany Increases Her Technical Journals.—There have been repeated rumors to the effect that Germany was badly in need of technical magazines. The facts are these: At the beginning of the war there were 6,250 professional journals (*Fachblatter*) published in Germany. Of these 1,900 suspended publication during the war, 90 of them permanently. But since 1919 the number has been gradually increasing. Today, says the Literary Review of the New York *Evening Post*, it totals 6,400, or 150 more than there were in 1914.

Substitutes for Bone Char Discovered After Sixty Years.—A powder company has announced that a satisfactory substitute for bone char or "bone black" as it is usually called, has been discovered after sixty years' search for a substitute for this splendid decolorizing material so useful in sugar refining. The substitute is manufactured from cheap carbonaceous raw material such as lignite, which is uniformly carbonized under conditions preventing the pores of the raw material being clogged by the deposit of secondary carbon.

Wireless Storm Warnings.—American mariners are to receive storm warnings by wireless from all parts of the world under arrangements perfected by the Shipping Board with most of the high-power radio stations in different countries. Managing agents and masters of Shipping Board vessels were notified that the warnings would be sent broadcast on schedules furnished by the ship's radio operators. Because of the number of vessels still on the seas without radio equipment, the warnings are to be passed on from ships receiving them by other means when such vessels are sighted.

Sunday Excursions a Hundred Years Ago.—The backslider who slides into a steamboat excursion better than he slides into his pew is not necessarily of this generation. In 1821 the clergy of New York City held a meeting at the City Hall to get the sense of the community. It did not take long to find out what the people wanted and they disapproved of the interference of the clergy. The speed of the steamboats was slow, six to nine miles an hour. Those going up the Sound could not always negotiate Hell Gate and the owners provided libraries sufficient for a modern liner to while away the tedium.

Naval Vessels Prevent Pelagic Sealing.—The U. S. Government is making every effort to protect fur seals from the poachers and to prevent the invasion of the breeding islands. It is estimated that last summer the number of seal in the North under the protection of the United States exceeded one million. More than a quarter of a million of seal pups were born. The mortality among the young ones is very great, probably 50 per cent, due to the fact that the seal is the food supply to bear, eagles, the deadly thrasher and other meat-eating fish. Naval vessels and revenue cutters will protect the few seals from pelagic hunters this spring during their migration to and from their breeding ground on the Pribiloff Islands in Bering Sea.

Astronomy

A Constellation on a Flag. — From a note in *l'Astronomie* it appears that the new regency of Fiume has followed the example of Brazil in emblazoning a constellation on its flag. The constellation selected for this purpose by the Fiumians is Ursa Major.

Novæ in the Andromeda Nebula.—Three more new stars have recently been found on photographs of the great nebula of Andromeda made with the 60-inch reflector of the Mount Wilson Observatory. Nova No. 18, the first nova found in this nebula in naerly two years (since October 30, 1919), is 50 sec. north and 50 sec. west of the nucleus, and is nearer to the nucleus than any other so far found except the great nova of 1885. Nova 18 was discovered in October, 1920, Novæ 19 and 20 in December, 1920.

The Wolf-Palisa Charts of the Heavens. — Dr. Johann Palisa, of the University Observatory in Vienna, proposes to continue the publication of the well-known Wolf-Palisa photographic charts of the heavens, if funds for the purpose can be raised by the sale of the remaining copies of the series already issued. The photographs were made by Dr. Max Wolf, of Heidelberg, with the 16-inch Bruce photographic doublet. Nine series of 20 prints each have been published at Vienna. They show stars down to about the 16th magnitude. The series now on hand are offered at the pre-war price of $10 a series, or $90 for the whole collection thus far issued.

Messier 72.—According to the last annual report from Mount Wilson, Dr. Shapley's investigation of the faint globular cluster Messier 72 has revealed the presence therein of many variable stars, 26 of which have been studied, giving the light-curves and periods characteristic of Cepheids of the cluster type, and indicating that the distance of this very remote cluster is 83,000 light years. Assuming the validity of Eddington's hypothesis of the radiative equilibrium of a giant star, Shapley has derived theoretically a period-luminosity law for Cepheids, and concludes that the average heat content per unit mass is nearly identical for all of these stars having periods longer than three days.

Early Astronomical Instruments. — The earliest known astronomical instruments of German make have recently been described by Dr. J. Hartmann, of Göttingen. They belonged to the philosopher and astronomer, Cardinal Nikolaus of Cusa, who lived from 1401 to 1464, and comprised a "torquetum," for measuring the longitude and latitude of the celestial bodies, an astrolabe, and two celestial globes. A note has been found in the cardinal's own handwriting, stating that he purchased three of these instruments in the year 1444, together with 16 astronomical treatises, for the sum of 38 florins. Dr. Hartmann believes that at least two of the instruments were made by one Nikolaus Heybech, of Erfurt, who was born about 1370.

Sensitiveness of the Retina.—A discussion has been going on lately in the *Journal* of the British Astronomical Association concerning the effects of the different degrees of sensitiveness of different parts of the retina upon visual telescopic observations. Mr. R. L. Waterfield, who started the discussion, described laboratory experiments showing that these differences are so marked as to affect, for example, estimates of the brightness of variable stars made by the method of "averted vision." Thus he finds that (1) the outer side of the retina is more sensitive than the inner or nasal side for red or green light; (2) with green light the lower part is more sensitive than the upper part, but with red light, and also in the case of the average star, the contrary holds: (3) there is a great fall off in sensitiveness immediately outside the center of the retina; (4) with red light the greatest sensitiveness is found in the upper and outer quadrant of the retina, between 1 and 3 degrees from the center. Mr. Waterfield's principal object was to point out how great an advantage could be obtained in the observation of very faint objects by arranging that they should fall on the most sensitive part of the retina, and that inconveniently bright objects in the same field should fall on the least sensitive part. Applications of this idea would be found in the observation of comets or faint satellites close to the sun. The discussion aroused by his paper has, however, centered about the question of the extent to which variable star observers use a method of averted vision in estimating magnitudes and whether their observations are seriously vitiated by this method. Mr. W. H. Steavenson suggests that any errors arising from this method could be eliminated by means of a left-to-right reversal of the field, by means of a diagonal eyepiece, the observer taking the mean of his estimates before and after reversal.

Aeronautics

The Pulitzer Race.—Elaborate preparations are being made by the Aviation Country Club at Detroit, Mich., for the Pulitzer Trophy Race which is to be held there on Labor Day. The fastest machines of the Army and Navy will compete and special contests will be held in connection with this event.

Airplanes to the New Oil Fields.—Two big all-steel airplanes to be used for transporting men and supplies to the Fort Norman oil field during the coming summer have been thoroughly tested at Edmonton, Alberta, and it is found that the machines can take off quite as well on skiis as on the wheels. Both machines will be fitted out with skiis, and it is expected that the new arrangement will prove of great advantage in landing on snow or ice.

Making All-Metal Plane Safe.—Recent changes in the fuel feed line and carburetor air intake in the Junker monoplane are said to have eliminated the fire hazard, for which these machines have received considerable adverse criticism. In the changes referred to, made by the Engineering Division at McCook Field, are included flexible gasoline line connections instead of rigid, and the carrying of the air intake outside the cowling where there is no danger of oil and gasoline around the engine being ignited by backfiring.

From Airplanes to Motor Boats.—On account of handicaps connected with the Peace Treaty, several German airplane works are taking up the design of motor boats. After comprehensive preparative work, one of the leading German aeronautical constructors has commenced on the construction of rowing and small-sized fishing boats. This firm has also completed two motor cruisers. However, in Germany as elsewhere trade is at its lowest ebb and motor boats do not find a very ready sale, hence aircraft constructors in some cases have already turned away from motor boats to total idleness.

Experiments with New Aircraft Carrier. — The French Navy have been experimenting of late with their latest aircraft carrier, "Bearn," while moored in the Toulon roads. The method used in landing is exactly similar to that experimented with by the British Navy, and consists of a certain number of wires stretched across the landing deck, and to which are attached sand-bags. The machine, which has a special hook attached to the tail-skid, on landing picks up these wires one by one, the sand-bags acting as a brake, the load being gradually increased until the machine is brought to a stop.

Still Smaller Airplanes.—The "scooter" of the air seems about to become an accomplished fact, we learn from *Flight*. A young French designer, M. Louis Goubert, has just completed the designs for a very small machine, which will be driven by an engine of only 10 horsepower. The machine is to be a tractor, with the pilot entirely enclosed in the fuselage, which will be provided with windows. The wing loading is to be 10 kilograms per square meter (about 2 pounds per square foot), and the maximum speed is estimated at 50 miles per hour, with a landing speed of about 20 miles per hour. A model of the machine is, it is stated, to be tested by M. Eiffel before the actual machine is built.

A Giant French Machine.—From France it is reported that the Etablissement Schneider of Creusot, manufacturers of guns, armor, locomotives and other steel products, are hard at work on a new four-engined military airplane in which the four engines will be arranged in tandem inside a central fuselage. The wing span will be about 100 feet, and the power plant is to consist of four engines of 400 horsepower each. The machine will be designed for bombing work, and will carry several machine guns. The Farman "Goliath" pilot, Lieut. Gonin, has been engaged to test the first machine, while it is possible that Casale, who has already tested the Bleriot "Mammouth," will test the second machine.

The Helicopter's Future.—British and French aeronautical authorities seem to be taking the latest helicopter attempts quite seriously, and look for early results in the way of practical flights. In France it is expected that the crack flier, de Romanet, who is attending the experiments with the Pescara machine already described in these columns, will be a competitor for the Michelin Cup some time this year. Captain Hugnet, another Frenchman who has had the most intimate connection with this same machine, is of the firm opinion that the Pescara helicopter will take part in a "closed circuit" event this year. It appears that the problem is no longer one of obtaining ample lift, but rather one of being able to control the thrust of the air screws, the general control when in the air, and obtaining good stability.

Keeping Our Railroads Up to the Mark

Pneumatic Apparatus That Constitutes the Prime Factor in Trunk-Line Maintenance of Way

By Robert G. Skerrett

Left: Air-driven corner-drill tightening up nuts on splice-bar bolts. *Center:* Air-operated tool boring holes in the ties for screw spikes, which likewise are driven home pneumatically. *Right:* Reversible close-quarters air-drill being used to turn up bolt nuts on a splice bar

The tools of the man who keeps the tracks in shape

THE rehabilitation of our war-worn railroads is going to entail the replacement of much material. Where this concerns the maintenance of way, and especially the laying of new rails, it will be essential to the national interest that the work be accomplished with the least possible interference with traffic. Economically, viewed from the standpoint of the trunk lines, it will be to their advantage to bring about the substitution of new rails quickly and by the employment of a minimum of labor. Mechanical facilities are today at hand that lend themselves readily to these ends.

The locomotive crane is not an unfamiliar apparatus to many people, and this equipment has proved well adapted to the rapid laying of rails even when these track members are of the heaviest types. Where the big and busy roads use rails ranging from 100 to 136 pounds to the yard it is easy to grasp the physical stress involved in the manual shifting and placing of these units; and there are seasons of the year when a large working force must be mustered to deal with a relaying job—this is particularly so during the summer months when such toil is apt to be very exhausting. Therefore, the locomotive crane is being more and more resorted to by progressive lines to speed up rail replacements while reducing greatly the measure of man power necessary.

But until recently the fullest service of the locomotive crane has not been permissible, simply because it could perform its part a good deal faster than the relaid rails could be properly bonded. By bonding is meant the boring of certain holes, the attachment of short lengths of wire through these holes, and the making of other electrical connections. Bonding is indispensable to the preservation of the metallic continuity of the track circuit by which the automatic signal system is functioned. Without these links the electric current would fail to flow and to operate the semaphores and the changing lights. In short, it would be dangerous, if not prohibitive, to run trains over tracks defective in this respect.

Drilling bond holes has commonly been a wearisome and a monotonous task, and long before a day's shift was done the men lost interest and dawdled over their work. Not only that, but a good many hands were needed to effect the desired execution. On one up-to-date eastern road, where the main line is laid with 136-pound rails, the locomotive crane has associated with it, in its relaying activities, an equipment that has robbed bonding of its drudgery and which has made it feasible to do this work at a rate of quite 100 rails an hour. As an example, fully 350 lengths of these heavy rails were unloaded and laid in a total elapsed span of six hours—the old rails being picked up and disposed of the while. Within an interval of sixteen minutes after the rails were in place and connected the bonding was completed.

To realize the time and labor saving represented by this typical performance, it should be recalled that the number of men required is not half the force that would be needed by the old and widely prevailing practice. The achievement has been wrought by amplifying the field of application of the mobile power plant designed primarily for the operation of pneumatic tie tampers. That is to say, substituting a group of air-driven drills in place of the usual hand tool. By these media the drilling gang can do more with less muscular tax in a given time; and because the work can be pushed ahead at a lively pace their interest in their task is not only stimulated but is sustained.

The extemporized outfit has taken two forms—consisting of a single unit in one case and of a triple unit in the other. The single unit is a small push car carrying a gasoline-driven compressor. Secured to one side of the housing is hung, parallel with the track and at a height of about 6 feet, a 21-foot length of 1¼-inch pipe with brackets at each end. These serve the double purpose of supporting the air hose and as resting places for the drills when not in use or during a shift from point to point. By means of a number of two-way connections it is possible to attach four lengths of hose to the primary source of energizing air, and this enables four men to drill simultaneously. The one shortcoming of this outfit is that the power plant must be shoved from place to place, and the work becomes rather taxing when it is necessary to negotiate a climb.

The three-unit installation is composed of a similar compressor and truck linked between two motor cars which speed up progress, make it practicable to mount any gradient at a good pace, and provide for the transport of the gang and for the accommodation of the tools, extra apparatus, bonding wire, etc. The little train is joined by two sections of 2-inch pipe, each 20 feet long, which are flattened at the ends and pierced with holes into which bolts or pins can be set to lock the cars together. The air is distributed from the compressor by an overhead pipe ¾ of an inch in diameter, having a reach of substantially 80 feet. This conduit is supported at several points by stanchions rising from the motor cars and from the car-linking pipes. The air main has a hose connection at either end and at two intermediate points. These taps feed four drilling machines, and air is supplied at a pressure of 80 pounds for that service. By reason of this arrangement short lengths of hose answer for the tools and to give the operatives free play.

As soon as holes have been bored at four joints, the drills are hung on hooks provided for that purpose on the motor cars, the men jump aboard, and the train advances to the next job. The shift to the succeeding "set-up," a rail length away, is effected in less than half a minute. With the hand-pushed outfit a crew

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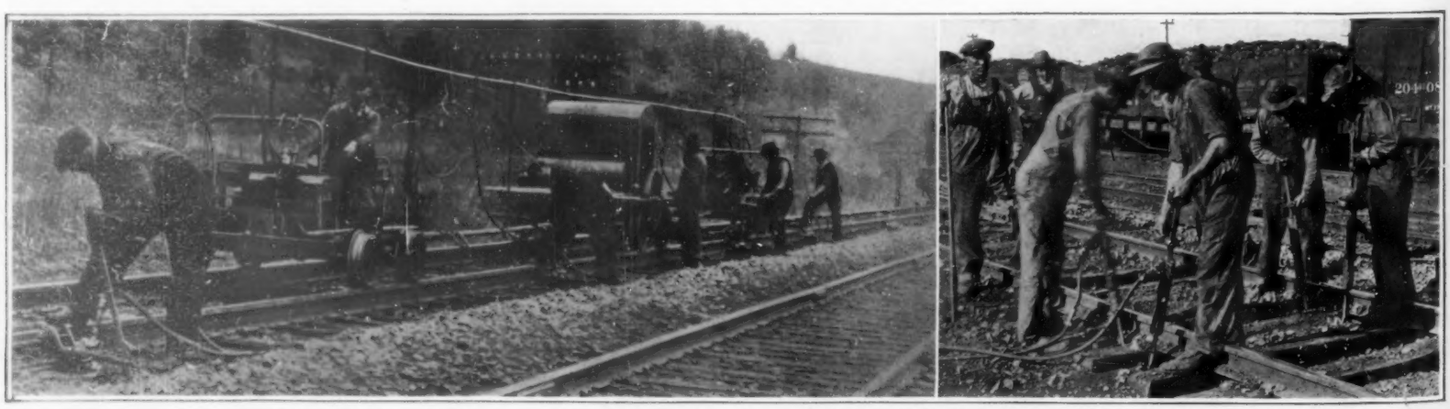

Left: Three-unit equipment engaged in rail-bonding. The four men are drilling bonding holes, using pneumatic tools. *Right:* Tamping ballast with pneumatic tampers, which do the work faster and better than picks, and with less tax upon the workmen

Keeping the tracks and the roadbeds of our trunk lines in order

Canada's Big Oil Strike

By Thomas M. Fraser

JUST 25 years ago the whole world was aroused by the story of the discovery of fabulous wealth in the Klondike, and for some years thereafter the almost inaccessible river beds and benches of the Yukon were the lodestones which drew adventurous gold seekers from all parts of the earth. Many great fortunes were made in what the Indians called the land of "too much gold"; many, too, were lost, and many lives along with them in the gamble with the relentless north. Now once more from the barren places of Canada comes the call to the prospector to try another throw with Fortune. This time it is oil; and judging from the preparations being made to be in on the game when the ice breaks on the great lakes and rivers in the Mackenzie district in the late spring, the Yukon will have little or nothing on the Mackenzie. The rush to the oil fields on the Mackenzie River will be one of the landmarks in Canadian mining history; and the Mackenzie will probably do for Edmonton what Dawson and the Yukon did for Seattle.

Communication between headquarters at Edmonton and the Canadian oil fields, nearly 1,000 miles distant, will be maintained by all-metal planes of this type

Toward the close of navigation last fall word filtered out by moccasin telegraph that a big oil strike had been made on the Mackenzie River. Later, accurate information was received by the Dominion Government that what looked like an important discovery had been made at a depth of 800 feet after prospecting and drilling operations extending over a year. This first gusher was struck at Fort Norman, which lies about 900 miles in an air-line northwest of Edmonton, on the right bank of the Mackenzie River. The distance from Edmonton by the ordinary routes of travel is about 1,750 miles.

The report of the oil company was sufficiently conservative: "Well is very encouraging, and while somewhat over-rated by the press, warrants the hope that prospecting of the area will result in sufficient production being obtained in a few years to warrant the development of some transportation scheme whereby the production can be utilized." Unofficial reports were to the effect that the flow would amount to from one to two thousand barrels per day. It was enough. If the clammy hand of winter had not closed down upon the territory, the rush would before now have been in full swing.

Toward the end of January, 1921, the Government suddenly announced that all oil and gas regulations in the Northwest Territories were suspended, and threw consternation in the hordes of prospectors who were outfitting in the north or actually in the field. The official announcement made when the regulations were suspended noted that the reported discovery of an immense oil-bearing territory in the Mackenzie River district, estimated to cover an area of 150,000 square miles, had for some time been receiving the attention of the Government. "There is reason to believe," it added, "that oil has been found in large quantities, and indications are that this district may soon become one of the greatest oil-producing areas in the world. The importance of such a discovery to this country cannot be overestimated, and the Government is watching the situation very closely. On the recommendation of the Minister of the Interior an order-in-council has been passed suspending all previous petroleum and natural gas regulations insofar as they apply to the Northwest Territories, the reason given for this action being that the Government considers the recent discovery of national significance and that the conditions are now the subject of careful inquiry."

Although there were numerous complaints regarding the Government's action, it was dictated by a desire not to be caught napping as they were to a great extent at the time of the Yukon discoveries. So far as the Government is concerned, it proposes to do everything in its power to see that wild-catting and exploitation of the public be made as difficult as possible, that legitimate prospecting be encouraged and that the state duly benefit from any discoveries made. The new regulations are devised with this end in view.

The history of the new Oildorado, as some wag has

(*Continued on page 395*)

Fort Norman, the town that has sprung up in the center of the new oil fields of the Canadian Northwest

Motorizing the Rural Church

By O. R. Geyer

THE old-fashioned rural church which dotted many thousands of hillsides a generation ago is rapidly disappearing these days in answer to the demand for greater efficiency and service in the work of the church. Hundreds of these small churches are no longer in existence and hundreds of others are doomed to disappear before the flood tide of the rapidly changing times has been reached. A responsible factor in bringing about this drastic change in the religious life of the rural community has been the automobile and its twin companion, good roads.

Rural life experts and leading church workers freely admit the part played by the motor car in bringing about this great change. The decline of the old-fashioned church first engaged public attention at about the time the automobile was gaining a foothold in the country districts, and from that day to this has continued with ever increasing force. Perhaps the chief reason for this has been the important part played by the automobile in annihilating distances and in bringing about a larger and better community spirit. Where three and four churches were deemed necessary a generation or so ago, because of poor roads and thinly settled districts, one church today is doing the work of its predecessors with much greater success.

Left: Two country churches, side by side, typical of the conditions of ten years ago. *Center:* A demonstration of the vogue of the motor among the church-goers of the countryside. *Right:* New type of rural worshipping place made possible through the popularity of the motor car, its congregation drawn from a wider territory, and more interested in appearances

The transformation of the country church effected by the popularization of the automobile

The falling off in the number of rural churches had reached what might have been an alarming rate but for other compensating factors in the days before the opening of the World War. Instead of halting this decline, the war served to make certain its continuation along more drastic and effective lines as it contributed to the quickening of the religious life of the country. The spiritual and economic influences brought to bear by the war have served to hasten the departure of the old order and the introduction of the new. Waste and inefficiency in worship are to be tolerated no longer, and the weak and ineffective churches which dotted so many rural hillsides are giving way to community churches which are bringing to bear a much stronger influence upon the religious life of the neighborhood.

Officials of the Methodist church, in a recent report, cite the automobile as an important factor in bringing about this important change in the religious life of the farming country. There is no bemoaning of the change, for church leaders as a rule are strongly convinced that the change is for the better. They are giving full assistance to the work started through the agency of the motor car and good roads, because they realize the necessity of the new rural church. An illustration of the good that is being ac-

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Fuel Conservation Opinions—II

What Leading Consumers of Fuel Have to Say About the Present and the Future

As Reported by Austin C. Lescarboura

EVERYONE connected with the work of developing water power seems to be quite positively of the opinion that the next few years will see a development of the hydraulic resources of the United States on a much more extensive scale than has existed in the past. There are several contributory reasons for such a vast development, we are told by Mr. A. K. Birch of the Allis-Chalmers Manufacturing Company, Milwaukee, Wis., which might be enumerated as follows:

1st. The high coal prices permit of utilizing water powers which have heretofore been left idle on account of high development charges.

2nd. Public sentiment seems to have become sufficiently educated to distinguish between conservation of exhaustible resources and an inexhaustible one.

3rd. Government approval of further water power development has been granted in connection with the passing of the new power bill.

4th. Not only have the limits of cost development been raised by reason of higher coal prices, but there is a considerable group of owners who are going ahead primarily on the assumption that they can secure greater returns from water power development by reason of absolute freedom from labor conditions in the coal field, transportation difficulties in emergencies, and the labor shortage, so far as their own coal-burning plants are concerned.

Saving Man-Power with Hydro-Electric Units

In the American Society of Mechanical Engineer's *Journal* of September, 1920, Mr. White, of the aforementioned company, makes a very significant presentation of the labor question in the following words:

"There has been installed recently at Niagara Falls a combined hydroelectric unit of 40,000-horsepower capacity. The operation of this unit requires two men per shift. It has been calculated that to produce the same amount of power by small isolated steam plants, as would be the case were the water power not developed, there would be required over 800 men to mine, hoist, break, screen, load, transport by railroad, unload, store, rehandle, and fire under boilers the coal necessary to develop by steam an equal amount of power. The operation of this one unit conserves not only one train load of coal per day, but also conserves the man power which would be required to produce it. This striking example shows the great amount of man power which can be conserved for other fields of endeavor by developing our water powers.

"May it not be that the shortage of labor to accomplish the tasks before us today has been brought about by the failure to follow that path in the development of our natural resources which leads to the minimum of human toil?"

Frankly, the case for the hydroelectric plant is admirably and convincingly put by Mr. White, although it will be noted that the labor shortage which he referred to in September, 1920, has to some extent disappeared in the short intervening period.

How Fuels Are Made to Do More Work

Six months ago it was the high prices and scarcity of fuel that caused many large consumers to seek fuel conservation; today it is the necessity of reducing costs in order to meet the buyer's modest and cautious bid that is again causing or is about to cause energetic fuel conservation in many quarters. At any rate, many interesting and novel economies are being effected, which tend not only to save fuel on the one hand, but, to put it another way, make each pound of fuel do more work.

One large consumer of fuel reports that in its power house the conservation methods have consisted of a development to utilize exhaust steam for heating purposes during the cold season, in addition to improvements in condensing apparatus and arrangements which improve the efficiency of the power house when it operates without the heating load, as well as during the cold weather. As builders of steam prime movers this consumer in question has given attention to the subject of reheating of steam. However, this idea has not been applied recently to any of its apparatus, although it did make use of such a plan several years ago in water works pumping engines. This company believes that such measures as reheating of steam will be warranted, provided the cost of fuel remains high.

It appears on careful survey that railroads of late are giving no little attention to fuel conservation. Thus Mr. A. T. Hardin, Vice-President of the New York Central Lines, informs us that his organization has a completely equipped fuel conservation department, which includes a fuel instruction car that is sent over the road with a staff of experts to assist in instructing engine crews as to proper firing methods, etc. This department also looks after the stationary boiler plants, where a campaign has been conducted with the view of obtaining economy in coal consumption, including proper heat insulation. The locomotives are all equipped with the latest approved devices for the economical use of fuel.

In the same vein runs the statement of Mr. W. L. Bean, mechanical assistant to the President of the New York, New Haven & Hartford. He tells us that his railroad has equipped its locomotives to a varying extent with such fuel-saving devices as firebox arches, superheaters, feed-water heaters, and stokers. Furthermore, a staff of fuel supervisors covers the system in order to instruct and demonstrate to the employees the proper methods of firing. Economies are also effected in stationary plants, with some additional refinements that are not possible in the usual steam locomotive.

Still another railroad, the Illinois Central, speaking through its vice-president, states that for a number of years it has practiced fuel conservation through educational methods, inspection of coal at the mines, and application of proven devices, such as super-heating, brick arches, etc. During the past eight years through systematic effort in this direction, the railroad has effected a reduction of over 34 per cent per 1,000 gross ton miles.

It appears that all railroads of the first order have for some time back paid considerable attention to fuel conservation, both by means of instruction to locomotive crews and by the installation of worth while devices. This fact is perhaps unbelievable to the average layman, whose rapid trips through railroad terminals with their vast stores of coal lying all about with seeming indifference, has naturally led him to believe that such a common commodity was being handled in an unsystematic and reckless manner.

Keeping Watch for Fuel Thieves

There are few large plants today which are not exerting every reasonable effort to use less fuel for more work. Such plants have in many instances equipped their boilers with modern mechanical stokers, and have carefully insulated their boilers and steam pipes so as to reduce losses through radiation to a minimum. Also, boiler settings are kept tight. In instances where it is estimated that considerable economies can be effected, steam units are changed around or even discarded for better equipment in order to effect real fuel conservation.

Most interesting of all, no doubt, is the careful watch maintained day after day for fuel thieves—those avoidable losses which subtly run up power producing costs. Thus many of the large fuel consumers watch their flue gas analyses for excess air, keep an accurate tabulation of firing conditions, and compare the results from day to day with past performance. Truly, we Americans are no longer the wasteful people which we have been pictured to be in the past by our European friends!

Any discussion of fuel conservation on a nation-wide scale brings up for discussion the super-power zone problem, which has been dealt with from time to time in these columns. In a word, the super-power zone means the grouping of all the large power producing units in a given area into one huge system, pooling the supplies and the production, and with transmission lines carrying the electric current generated in all directions. The super-power zone, operating on a vast scale, insures the economical production and distribution of power in a manner that is quite impossible with our present system of scattered and isolated plants.

Grouping Power Plants Into Super-Power Zones

That the idea of super-power zones is not altogether an untried one may be gathered from the facts regarding the Ontario Power Commission's work, which recently appeared in these columns. Furthermore, we are now informed by Mr. R. H. Ballard, Vice-President and General Manager of the Southern California Edison Company, that the power systems of California have been operating for the past several years to some extent on an interconnected basis, making power interchange between the separate systems whenever economies could be effected. At the present time the systems of California, extending the entire length of the State from San Diego to the Oregon border, a distance of about 700 miles, may be interconnected, although in some places by low capacity connections. The near future will see this entire territory supplied by a super-power bus operating at 220,000 volts and supplying the local distributing systems along its route.

The advantages resulting from the diversity of loads in contiguous territories supplied by separate systems, and the economies of development on a large scale of big units, will bring about a more extensive interconnection or consolidation, concludes this authority.

Of course, the super-power zone idea works out best where we are dealing with a densely populated section of the country. In connection with this idea, one authority suggests that the location and size of the power plants and the prime movers installed in them, should be such that it will be possible to take full advantage of the use of exhaust steam for heating and industrial purposes. Still another authority states that the grouping of power plants will, of course, enable the plants so grouped to obtain a more economical load factor and will also make possible the use of large stoker, boiler and turbine units, with attendant savings through the inherently better efficiency of the larger units.

Returning again to the subject of district heating, we are told that the "grouping" of power plants would appear to overlook the great importance of district heating in the various cities. When the best economies are worked out, indicating the advisability of the larger installation, consideration should be given to the "stand-by" plant, which will insure uninterrupted electric service and secondly, make possible the continuation of the present heating system or the taking care of heating requirements, from the present centrally located power plant. A great many competitive situations are created when and if the power plant, with the single idea in mind of grouping, neglects the present or prospective demand of central heating in the cities. This plea of giving due consideration to the central heating problem is worth listening to; for there is only a limited gain should economy be effected in the generation of electric current, while more fuel must be used for the heating of cities. The suggestion has been advanced by several authorities that in the super-zone scheme the present steam plants should be used as "stand-by" plants, ready to generate electricity in an emergency, while in normal periods furnishing steam heat to city offices and dwellings.

As with most other projects, there is another side to the super-power zone. Admitting that the shutting down of small plants can be accomplished with a saving of much fuel, many hold that the time is not ripe for such a grouping of power units.

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IF, as was discovered upon reading in our last issue the first instalment of this article, which is herewith concluded, there are so many and varied opinions regarding the most satisfactory fuels now in use, the same may be said for the new fuels and sources of power for the future. It is quite to be expected that each fuel consumer has his own opinion as to what will constitute the fuel and the power of tomorrow, since he looks at the problem through his particular spectacles, so to speak. He sees the problem in the light of his present requirements and past experiences, and proceeds to offer a solution accordingly. All of which is what makes such an interchange of opinions all the more interesting, presenting, as it does, so many different yet worthy viewpoints.—THE EDITOR.

Farming with Electricity

A Hundred-Thousand Acre Tract That Is Fully Equipped with Modern Machinery

By Ralph Howard

HOW the barrenness of the desert has responded to the reclaiming touch of man is an oft-repeated story of the West, the Government project embracing 121,310 acres in Cassia and Minidoka Counties, Idaho, being a notable illustration. The astonishingly swift transformation of this once vast area of desolation into a fertile farming region—all within 13 years—is an inspiring achievement of itself, but of more singular distinction is the conspicuous rôle that electricity is playing in the farm homes of this big agricultural community. With 1,100 farmers applying electric current in producing and harvesting their crops, doing the chores of the housewife, and illuminating and heating the homes, schoolhouses and churches, no other rural section in the United States has accorded such all-embracing favor to this form of power as has this hydroelectric project in south central Idaho.

Electricity as a servant of city dwellers is of increasing popularity, but its common adaptation to rural life is a dream of future accomplishment. Its use in agricultural areas is a novelty, restricted to isolated examples in progressive communities. Herein the Minidoka enterprise, administered by the Reclamation Service of the United States Department of Interior, takes a radical departure. Electric current becomes an agent of almost universal recognition in an expansive rural area, where the most populous town, Burley, claims only 4,000 inhabitants. Rupert, a village of ranking importance, has barely 2,500 souls; the two mentioned burgs being products of the reclaiming powers which extended its magic wand over 121,310 acres and transformed the desert into agricultural units yielding a wealth of alfalfa, potatoes, sugar beets, small grains, as well as nurturing a beef and dairy cattle industry. No manufacturing industries of consequence are fostered; two beet-sugar factories, a potato dehydrating plant, two cheese factories, and several alfalfa mills, constituting the magnitude of manufacturing. All of which brings into relief the aspects of a slogan of the city, "Do it electrically"—applied on the farm.

The engineering equipment includes a diversion, power and storage dam on Snake River, 7 miles south of Minidoka, two canal systems, one on each side of the river at the diversion dam, and three main pumping stations. There are 634 miles of canals, and the gravity system embraces 72,348 acres. The power plant is a creature of necessity in pumping water to approximately 50,000 acres during the irrigation season; thereby, the electric current distributed to country dwellers is a by-product. Of the 3,000 consumers of electricity, 1,100 are honest-to-goodness farmers. Substations have been built and distributing stations have constructed 290 miles of 2,200-volt circuits, extending 250 miles through rural communities. Although avoiding extensive retailing of electric power, the Reclamation Service takes the initiative in the organization of companies composed of farmers, which are incorporated and operate as mutual enterprises under the statutes of Idaho. These operating units build their own 2,200-volt lines, install transformers, and dispense current to individual consumers. The Federal Government acts as a wholesale distributor of power which is obtainable at substations conveniently located on the 30,000-volt transmission system.

The energy as supplied wholesale by the Department of Interior to farmer companies is based on a charge of $2 a month per kilowatt of maximum demand for the equivalent of the first 50 hours' use of the maximum demand for the month; 3 cents a kilowatt-hour for the next 50 hours' use of the maximum consumption; 2 cents per kilowatt-hour for the succeeding 50 hours' consumption of the ultimate needs; 1 cent a kilowatt-hour for the next 150 hours' use of the maximum requirements; and ½ cent a kilowatt-hour for all energy used in excess of 300 hours' use of the supreme needs. The rate also recognizes a block discount based on the contractor's guaranteed maximum demand, increasing from 2 per cent for 2-kilowatt contracts up to 30 per cent for a contract of 100 kilowatts or more. Likewise a discount of 10 per cent is granted wherever energy is delivered and measured at 2,200 volts. A rural distribution line, including accessories, can be built at an expenditure ranging from $500 to $1,000 a mile; ordinarily four farms being linked for each mile connected to the circuits. The farming unit is 80 acres. Twenty farm companies have been organized, supplying approximately three-fourths of the rural consumers. Other users receive their electric current from lines vitalized by the systems of the various towns, barring 40 farmers who obtain a supply direct from the Government on individual contracts.

Interesting observations have been assembled as the results of study of the distribution of electricity on this Government project, which is the premier rural consumer in the United States. The use of a diversity of electrical appliances improves the load factor, and the energizing current of the rural dwellers' transformers floating on line likewise enhances the load factor. The load tests indicate that the companies' peak burden is always at the time of the lighting peak. The individual farmer consumer has a day peak, which averages three times his average night peak. The diversity of the day burdens, however, is such that the excessive individual needs do not affect the companies' maximum demand. The companies' evening peak is three to five times greater than the day load. The power factor of a rural company rarely exceeds 50 per cent except during the evening lighting peak. Distribution losses in kilowatt hours range from 30 to 50 per cent, primarily attributable to the energizing current of the transformers. One-half of the rural distribution systems employ iron wires for conductors. The largest company on the project serves 165 farmers on 38.5 miles of line, comprising 13 miles of 3-phase No. 6 copper wire, 3 miles of 3-phase No. 8 iron wire, 3 miles of single-phase copper, and the remainder single-

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Correspondence

The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.

The Einstein Contest

To the Editor of the SCIENTIFIC AMERICAN:

It is a real pleasure to read the prize essay on the Einstein theory and note the absence of weird mathematical symbols. One who has completed the ordinary college mathematical courses including calculus, feels that he has a real grievance when he encounters strange mathematical symbols, with no hint as to what they mean or how their meaning can be found at the library. He may also have a sneaking suspicion that the thirteen super-minds might be slipping something over. Having hastily suppressed that thought, perhaps he recalls instances where he himself has used mathematics to solve a problem and found that there was more than one answer. Perhaps one of the answers involved $\sqrt{-1}$ known as an "imaginary" answer, or for some other reason the conclusions drawn from it would be even stranger than those of the Einstein theory. All of which confirms the proverb that mathematics is a good servant but a bad master.

The statement that a yard-stick changes its length when turned around 90°, and that a watch runs at a different rate when on a fast train, will not be accepted by the skeptics on the mere statement that it is so, nor on proof so entirely mathematical as to be beyond control. Of course the essayist could not be expected to prove anything. He was only expected to explain, and this he has done so well that he, Mr. Higgins and the SCIENTIFIC AMERICAN deserve the greatest credit.

The weak point is the failure to state definitely the fundamental assumption on which the entire theory is founded, viz.: that the absolute velocity of light (in a vacuum) is constant. In other words that all space is filled with a fixed ether that does not partake of the motion of the earth. This ether was invented long ago to explain the transmission of light. A very attenuated kind of super-gas will not answer the requirements. It must be a solid body, vastly more rigid than the strongest steel, and yet allow the earth to pass right through it without offering the slightest resistance and without being displaced the slightest amount by the earth. In accepting such an ether, one is simply forced to make some mental reservations. Perhaps it should be taken in the sense of the familiar comparison between electricity and a circulating system of water pipes. It can't be taken too literally.

While such a fixed ether explains nearly all the facts about light, it does not explain quite all. It is directly contradicted by the measurement of the aberration of light, with a telescope filled with water. The ether theory is not so well established but that it is still subject to minor modifications. The ether, for example, may not be fixed; some of it may be carried around with the earth, and there have been other suggested modifications of the ether that would entirely upset the Einstein theory.

With a fixed ether, of course the earth would sweep through it at some 18 miles a second, in its orbit around the sun. At midnight the ether would seem to us to be coming from the east. Its direction would change, as the earth rotates on its axis, so that by morning it would seem to be coming down on our heads.

This is the way the ether was supposed to be sweeping through the laboratory while Michelson and Morley measured the velocity of light. Yet it was found that the apparent velocity of light was the same at all hours, and that is right where the trouble started that is threatening to drive us crazy.

To the normal mind this experiment simply showed that the ether was not rushing through the laboratory at 18 miles a second. Einstein's deductions are all the proof that is necessary that the laboratory was not moving through the ether at all. But the German mind when confronted with the discrepancy between the theoretical result and the experimental result, instead of seeing that one or the other result must be wrong, saw that both results were right and all the rest of the world wrong. So the discordant results were equated to each other, the equation was solved, the interpretation of the solution was proclaimed, and the world was plunged into mental anarchy.

But let us make another experiment. This one won't cost anything because the skeptics will agree with the super-minds as to the outcome and will disagree only on the explanation. Let us take two clocks; one with a balance wheel escapement, the other with a pendulum escapement. The axis of the balance wheel will be placed parallel to the axis of the earth. We will neglect the velocity of about a quarter of a mile a second due to the rotation of the earth on its axis and assume that the motion of the axis of the balance wheel through space is uniform. The time rate of this clock will therefore be uniform. The pendulum of the other clock will beat at the normal rate at noon and midnight when its motion through space is transverse. But in the morning and evening its motion through space will be endwise, and Einstein tells us that its length will shorten. Therefore it ought to beat faster. If the earth's radius also shortens, gravity ought to get stronger and cause the pendulum to beat still faster. Every one will agree that the two clocks will actually keep together. To the skeptics there is nothing about this to explain. It is up to the super-minds to show some effect that would exactly compensate for the supposed change in length; presumably by amending the law of gravitation. It would be very interesting to know how this can be done without annuling their proof of the motion of the planet Mercury. But we will never know; because if they should answer this question it would be with another flock of weird symbols of unknown meaning. GILBERT S. WALKER.

New York.

The Knife and Fork in One

To the Editor of the SCIENTIFIC AMERICAN:

In a recent issue I saw a description of a "new" combined knife and fork for the use of maimed soldiers. I think, but am not sure, that the implement in question was sold by Gamage of London, Eng., long before the Great War.

It is a very old tool; by the courtesy of Messrs. Read of Dublin, I was allowed to make a tracing of their model, the age of which is uncertain, but well over 120 years. This firm sells occasionally to special customers razors, knives (all descriptions) and scissors guaranteed over 100 years old. The steel is known to them as "silver steel," is of magnificent quality, polishes the color of silver, and retains the edge for years without regrinding, or in the case of razors, resetting. The business was started 273 years ago and has continued without a break. (Rev.) R. W. TALBOT.

Loughrea, Ireland.

When Oysters Are in Season

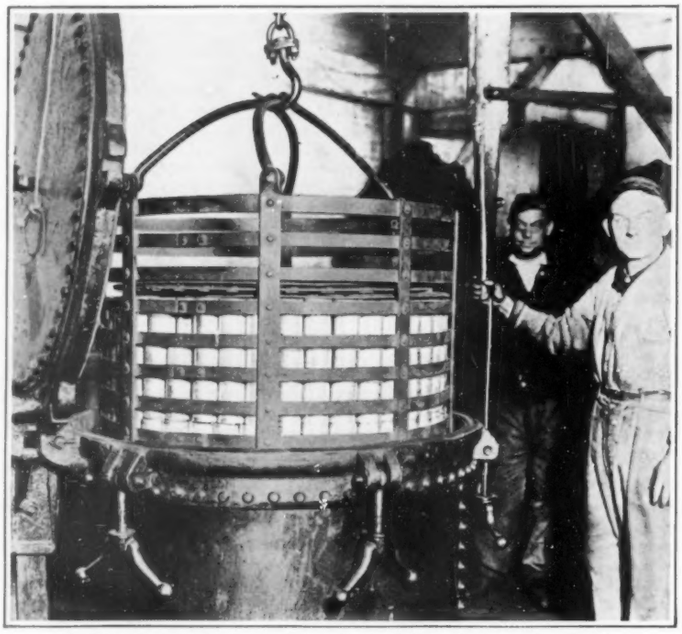
How the Raw and the Canned Products Are Prepared for the Markets

By S. R. Winters

"OYSTERS a Specialty in Season," is a familiar inscription in the city, with slight variance of the text, oyster dealers, grocerymen, restaurant and hotel proprietors contributing to the frequency of its appearance. As stimulating as the imagery may be to the appetite, suggesting an inviting dish of raw, fried or one of the sundry ways of serving this relished water product, the consumer hardly realizes the vastness of the oyster industry. Well may one marvel, then, when informed that the highway bearing the speeding automobile is likely built of oyster shells; the railway express may be steadied by a ballast of fish shells; that grit may be supplied to the craws of backyard poultry; and excessive acid soils of farming land may be relieved by lime produced in a kiln of burning oyster shells.

Oyster culture represents the most valuable fishery in the United States. The 1920 yield approximated 30,000,000 bushels, having a valuation of $15,000,000 to fishermen. The latest inventory as to the magnitude of the industry in personnel and equipment employed for twelve months indicated that 67,257 persons were thus engaged, drawing wages aggregating $10,876,801, using vessels and apparatus appraised at $17,000,000. Ninety-nine per cent of the oysters are taken from the Atlantic and Gulf coasts, Maryland, Virginia and Connecticut, in the order named, having foremost ranking in yields. Chesapeake Bay, this story threading itself around its fishing activities primarily, gives up more oysters than any other body of water in the world. Virginia and Maryland, through which this huge pond navigates, produces 5,000,000 bushels of oysters each annually. Connecticut is credited with an output of 4,000,000 bushels.

Hand tongs, patent devices, dredges lifted by hand or hand windlasses, or dredges raised by engines or hoisters turned by the engine of the boat, are the implements used in lifting the oysters from their watery beds. Hand tongs have common usage, the device comprising two long, flat, smooth wooden handles three inches wide and one inch thick bolted, riveted or pinned together with a wooden pin, scissor-like fashion, about four and one-half feet from one end, leaving the long ends for handles. To the short end of each shaft is secured at right angles a light iron bar, three and one-half feet long, spiked with teeth, while above the bar are five or six even lighter bars or heavy wires parallel to the bar and attached to the shaft. The ends of the bars are secured together by abbreviated wires. The arrangement on each shaft permits the teeth to slope inward, thereby forming a basket-like contraption when the handles are closed. Its dimensions are three and one-half feet long and eight or ten inches deep. In action, the handles are negotiated as one would a pair of scissors, and the teeth forced under the oysters retained in the basket, which is then lifted. The depth of the water being explored determines the length of the oyster tongs. In one instance the apparatus is inserted to a depth of 20 feet.



Basket of canned oysters being lowered into the steaming kettle

A hand dredge consists of two triangles constructed of three-fourths inch iron bar, joined at the apices, and the bases separated 18 inches by curved bars. Its width is four or five feet. The base of the lower triangle being composed of a bar one and one-half inches thick, to which teeth three inches long, set three inches apart, are placed. A rope or wire cable inserted in a ring at the apex of the dredge permits the lowering and raising of the fishing tackle, hands or hand windlass being employed. Maryland sanctions the use of a heavier dredge, which is operated by a donkey engine having quarters on the deck of a sailing vessel. Legislation prohibiting the use of other motive power than sails in dredging, the engine simply operates the dredge. The vessel is propelled exclusively by sails. As depicted in the illustration, the oysters are shoveled from the deck into buckets and hoisted to the wharf by a rope over a pulley and operated by a crane with a donkey engine as a source of power. The buckets having been emptied on to the wharf, the contents are subsequently removed in wheelbarrows into a room level with the wharf where the oysters are deprived of their shells. Quite logically, the process is called shucking.

Oysters are marketed in three conditions—in the shell, shucked on ice, and canned. The first two named forms have given birth to the so-called raw-oyster house, while the latter state of preparation involves the establishment of a cannery. The products are shipped in the shell in barrels, although for short hauls they may be consigned in sacks without ice. Refrigerator cars are employed for long-distance journeys. Export trade

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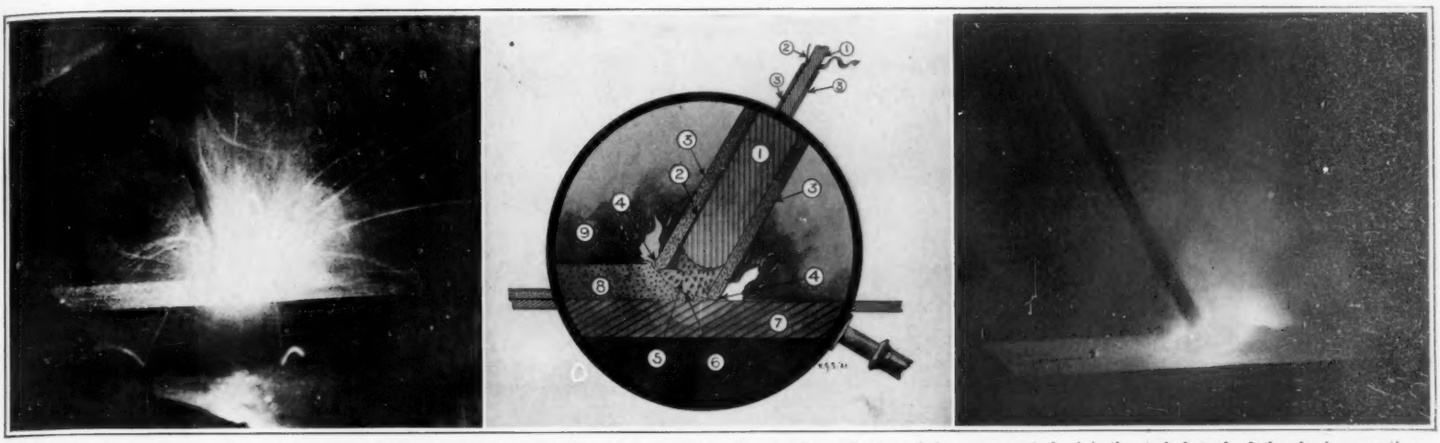
Left: Washing fresh oyster meats on the skimming board, perforated to permit the water to drain off. *Right:* Lowering a dredge for oysters. From one to three of these are operated on each side of the boat. *Above:* Hand dredges and winches for hoisting them

Scenes from the Chesapeake Bay oyster industry



Left: The ordinary open arc weld, showing how the incandescent and vaporized metal is scattered. *Center:* The mechanism of the newer method. 1 is the steel electrode, 2 the aluminum coating, 3 that of blue asbestos, 4 the asbestos sleeve which confines the vaporized steel, 5 the electric arc itself, 6 the metal deposited by it, 7 the plate upon which is being built up the welded mass, 8 and 9 the asbestos slag lying on the surface of the deposited steel. The electrode is moving from left to right. *Right:* Photograph of the quasi-arc weld, showing how little metal is lost and how well protected the weld is from the air. Compare this business-like bit of welding action with the spectacular but inefficient open arc at the left

Arc welding by the recent process that conserves the metal and excludes the oxygen and nitrogen of the air

A Stride Forward in Electric Welding

ELECTRIC-ARC welding is not in itself a novelty; it has had a practical place in industry for twenty years or more. In the past, however, the arc weld served principally to effect mere union between contiguous metal surfaces and was not expected to meet the alternating stresses set up by any considerable live load. The arc weld answered satisfactorily for the joining of light metal parts, but there seemed little to encourage the belief that the process could be applied successfully to the more rigorous conditions imposed in heavy steel structural undertakings, such, for instance, as in shipbuilding operations, massive repair work, etc.

Sulfur print from polished bar welded by quasi-arc process

But the recent conflict emphasized the need of haste, the minimizing of labor, and, withal, the production of steel fabrics measuring up to prescribed standards. Then advocates of the electric-arc weld urged a wider application of that medium, and many of them were sure that it could be substituted offhand for riveting which had so long held the field. It is a matter of common knowledge that arc welding was by no means an unmixed blessing; in some directions it met expectations and made repairs possible in a comparatively brief while which otherwise might have taken months more to do. But investigation showed that the weld introduced metallurgical modifications of a serious character—in short it was revealed that the metal of the weld was apt to be inferior to that of the bodies which it bound together.

The fact that such was the case is not hard to understand if heed be given to some of the phenomena developed within the arc and the metal immediately subjected to its fusing action. The intense heat of the arc is much higher than that of the steel furnace, and by reason of this the fused metal volatilizes to a degree, not only losing a percentage of its alloys but being affected simultaneously by the free oxygen and nitrogen of the surrounding air. A knowledge of these hurtful actions naturally suggested the use of electrode rods high in carbon, silicon, and manganese content so that a portion of these alloys could be dissipated and yet leave enough of them in the deposited metal to make it at least equal in its composition to that of the steel masses which it served to unite.

This was, undoubtedly, a step in the right direction, but it still left much to chance, for it was not feasible thus to control the percentage of volatilization, nor did it prevent the propagation of weakening oxides and nitrides—the air could reach the molten metal just when it was most susceptible to the atmosphere's injurious action. Plainly, the electric-arc weld to be satisfactory called for the exercise of much anticipatory care in the preparation of the electrodes as well as a high degree of skill during execution. These prerequisites stood out in marked contrast to the requirements of successful riveting. But the whole subject gripped the imagination of the technicist and the inventor, and the creative mind set itself to the task of solving the problem. Much has been done to make the electric-arc weld adaptable to the various physical conditions imposed in the building of a ship, and it is now claimed that the arc weld can be used wherever a rivet can be driven. Not only that, but it is said that the welded joint is both better and cheaper than a riveted one.

No small measure of this advance is due to what has been achieved in developing the so-called quasi-arc system of welding; and we shall see that in this improvement in the art the steel maker's practices have been applied in miniature to the diminutive furnace represented by the fusing heat of the electric arc. The steel maker takes care, while his metal is in a molten state, to cover it with a cloak or bath of slag which stands between the metal and the atmosphere. Again, just before the steel is poured into the ingot molds, for example, a small percentage of aluminum or some other deoxidizing agent is thrown into the ladle, and this medium promotes the expulsion from the liquid steel of any contained bubbles of oxygen—it purges the metal and leaves it quite like a glass of soda water from which the gas has escaped. Now let us see how the same results are obtained in the case of the quasi-arc.

To begin with, the composition of the welding rods or wire electrodes is fixed agreeably to the character of the metal surfaces that are to be united, allowing, of course, for some volatilization. So far,

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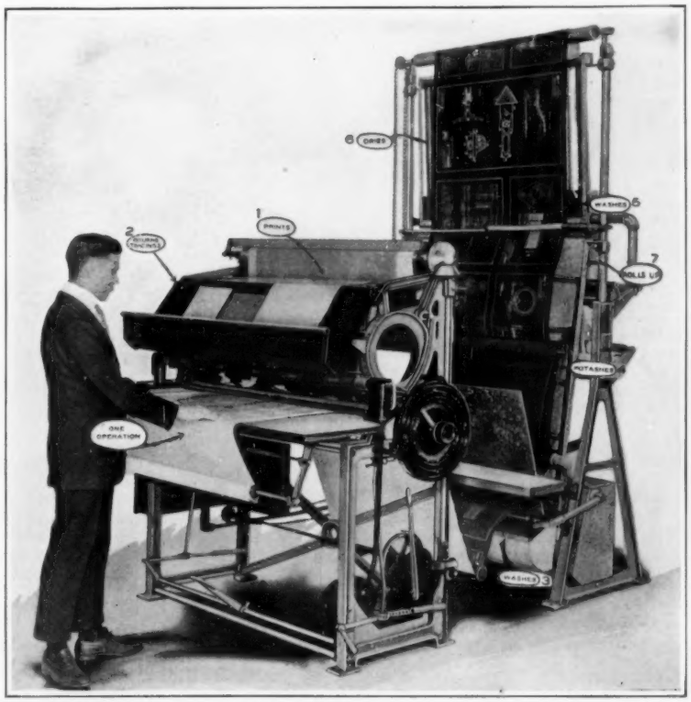


The machine that prints, washes and dries blue prints in a continuous operation

Recent Progress in Blue Printing

HERE is a threefold blue print machine capable of printing, washing and drying in one continuous operation. Only one operator is required, who places the tracings on the sensitized paper, which is fed from a roll and carried past a bank of arc lamps, when the tracings are automatically separated from the paper and deposited in a tray.

After exposure the paper continues its course, first through a bath of clear water then through a weak solution of bichromate of potash or soda and again through clear water, afterward passing up over the dryer and then down to a winding device which makes a loose roll of the prints perfectly free from wrinkles or distortions and all ready for trimming.

The paper is washed on the sensitized side only by means of a spray of water, which carries off all surplus chemical. The drying process is uniform, and as the paper is under tension much of the usual shrinkage is eliminated and the prints brought close to true scale. As a result of the passage of prints through the bichromate bath, the color is intensified and the effect of any over-exposure removed, while the washing process is materially shortened. The solution is forced through a perforated pipe by means of a small pump and all surplus is returned automatically to a tank from which it can be drawn for a renewal of the cycle.

Fixed Stars That Are Not Fixed

How Their Motions Are Detected by Making Them Wink at Us

By J. F. Springer

THE fixed stars are those whose relative positions with respect to the generality of stars remain unchanged from moment to moment, night to night, year to year, and perhaps age to age. And yet there are some of these bodies whose relative positions undergo for the unassisted judgment no shiftings but which upon the application of certain instruments of precision are found to have really suffered displacement. It is generally believed in astronomical circles that *all* the stars loosely termed "fixed" are really in motion, but that these motions are difficult to detect because of the enormous distances. The matter is still further complicated by the consideration that stellar objects moving in the line of sight will show no relative displacements. However, we are fortunate in possessing the spectroscope which is peculiarly adapted to detect precisely this type of movement and to furnish a means of estimating its rate. Further, this instrument enables us to distinguish approach and recession.

Displacements perpendicular to the line of sight constitute a different problem. One might suppose that, if a star map were made today by locating the various stars by means of the positions determinable with the aid of telescopes and clocks and a second map made in a similar manner but at a later date, any displacements would be at once disclosed. The trouble with all this is that the great bulk of the stars show no change of position when dealt with thus. The variations in position are, in fact, for the most part of a truly microscopic character. Furthermore, while now and then a stellar point is found to have shifted sufficiently to make the displacement gross enough for the usual methods to detect, the number is comparatively so few as to make it well nigh useless as a means of getting a satisfactory conception of the universe of stars.

Photography has, however, come to the rescue. By means of a single negative thousands of star positions may be relatively determined. Given two negatives of the same field representing the conditions at separated moments, if the one be superimposed upon the other with their relative positions fixed by matching two or three or more of the points representing stars, the generality of the one set of points will agree with the generality of the other. But attentive observation by a trained eye will discover slight displacement down to a reasonable minimum. Harvard Observatory has been conspicuously identified with this method of determining small movements perpendicular to the line of sight. A refinement upon the direct comparison of two negatives consists in comparing a negative of one date with a positive of another. Upon the negative, the stellar points show as small dark points; but upon the positive we have instead small white points. The foregoing methods may be summed up as those followed at Harvard. Many hundreds of variable stars and one star of considerable proper motion are said to have been discovered by these methods at Harvard Observatory.

There are very many stars and the displacements are doubtless minute for the most part; so that the Harvard procedure would probably require a great period of time and would perhaps fail to discover displacements of extraordinarily small amounts. How vast the number of stars in the heavens really is may be roughly conceived perhaps by noting that of the 12th magnitude (photographic) as many as 1,600,000 are estimated to exist, and that the number roughly doubles with the addition of a unit to the magnitude. If the Franklin-Adams scheme for the photographic reproduction of the skies is carried out to completion, the number of stars on the plates will, it is estimated, total something like 65,000,000.

What appears to be an improvement upon Harvard methods makes use of the *blink microscope*. This instrument aids the human eye to detect, upon comparing two views of the same stellar field, all displacements amounting to 1 or 2 seconds of arc, or more. While the instrument itself was invented some years ago, its practical application, for some reason or other, has not proceeded very far as yet. Nevertheless, many hundreds of plates have been examined and some tentative results already determined. First, the instrument discloses that about ½ of 1 per cent are probably stars having at least a displacement of 5″ in a century. Next, the new procedure tells us, the moving stars are not traveling in random directions. Only about ten per cent have haphazard lines of movement. Of the remaining 90 per cent of moving stars, about two-thirds are traveling in a certain general direction, and the other third in the opposite direction. Again, stars of all magnitudes are moving, but the various magnitudes do not behave alike. Thus, the greatest number of displacements is to be found in stars of the 11th and 12th magnitudes. Another matter of interest concerns star clusters. Relatively to their neighbors, clusters of stars are disclosed as at rest. Still another result has to do with geographical distribution. One might perhaps have expected that the region of the Milky Way would contain a relatively large number of moving stars. On the contrary, as Mr. R. T. A. Inness of the Union Observatory at Johannesburg, South Africa, tells us, moving stars are distributed rather evenly throughout the skies, but if anything they are more frequent in sparse regions. The very faintest stars—that is stars of the 16th magnitude—are, when found to be movable, situated not so distant from the Milky Way. The foregoing conclusions are to be viewed as strictly tentative. They are founded on information that is, as yet, inadequate for strong, final conclusions. At the same time, they represent inferences from a considerable number of applications of the instrument, and are to be held in memory.

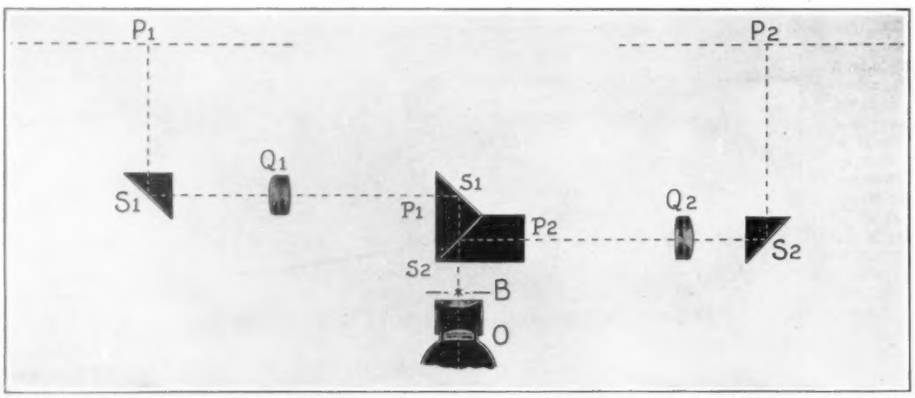
When a pair of plates represents an interval of 25 years, the blink microscope shows that, on the average, there are about 3 displacements on each square degree of field. But this is not the end of the story. It has been suggested that as the plates represent longer and longer intervals of time, so the number of moving stars will increase. This is to be expected, surely. With longer and longer periods of time small movements as yet undiscernible would continually pass the threshold and come within the power of the blink microscope. Professor Turner has voiced the conjecture that the number will increase as the square of the interval. Upon the present datum that there are disclosed by a 25-year interval three moving stars in every square degree, the whole sky should yield, according to Mr. Inness, some 200,000 moving stars. Adopting Professor Turner's rule, one may readily conclude that for a century, the yield should be 16 times the former, or 3,200,000. Even so, the number of stars actually in the fields disclosed would be far greater, being a total of some 16,000,000. However, by the time the century is completed, the blink microscope may very well have been superseded by something far better, or some other method than the comparison of photographic records may have been devised for the purpose of informing us as to displacements perpendicular to the line of sight. On the other hand the blink microscope is probably the best means at present available.

The blink microscope appears to have been a development of the stereocomparator. When a pair of plates of the same field is examined by means of the latter instrument any object of the field which has shifted its position will stand out stereoscopically. That is, one will be able to pick out the object because it is now appearing in three dimensions instead of two. This, at any rate, is the theory of the matter. It is said that, in practice, not only do the objects which have shifted stand out stereoscopically but many others do so as well. It is suggested that this may be due to some small distortion of the image, or to the eye itself. If the eye is responsible, then the result may be due to some physiological "expectation" in virtue of which small objects are seen as more distant than the large ones. "Suspicious objects are, however, noted at the stereocomparator and are then measured to find if the displacement is real."

It will be gathered from the foregoing, perhaps, that the stereocomparator lacks something of perfection. The blink microscope improves upon it because it depends upon more suitable principles. The latter instrument is not binocular at all. Stereoscopic effect is given up. But the two plates representing the beginning and end of a time interval are set in the instrument as if it were expected to view them stereoscopically. Here we have a distinct departure from the

(*Continued on page 400*)

THE astronomer uses all sorts of interesting and amazing tools, and we are quite accustomed to seeing him get results out of one of his tools which we would not have supposed were in it. A case strongly in point is the spectroscope; surely no one would have imagined, a priori, that simply by passing light through a couple of prisms it would be possible to analyze chemically the star from which it comes, and tell how fast it is moving toward or away from us. Another instance is the blink microscope of which Mr. Springer tells us here. By a simple device utilizing the principle of persistence of vision, on which the motion pictures depend, it turns out that we can tell with extreme accuracy whether a star has changed its position between the time of taking two photographs of the region in which it lies; and if it has done so, by how much. This is the tool which gives us our present large insight into the proper motions of the fixed stars—one of astronomy's most important pages and, until recently, one of its most obscure ones.—THE EDITOR.



Light from P_1 and from P_2 passes with equal intensity into the ocular of the microscope at O. If first the one ray and then the other is cut off, for periods shorter than the interval of "visual persistence," the eye will not detect the fact that it is looking now at P_1 nad now at P_2 so long as the the fields are identical. But if corresponding points of light in the two fields are not at exactly the same spot, they will "blink" as the shutter cuts off first the one and then the other

How the blink microscope reveals infinitesimal shifts of position in successive photographs of the same stars

Left: **Working platform, near one of the towers of the Williamsburg Bridge, at a point 300 feet above the river; also the machine for winding the wire on the cables.** *Right:* **Near view of the electrically-operated trolley, showing the wrapping wire passing from the spool to the cables**

Re-Covering the Cables of the Williamsburg Bridge

IN order to give the wire cables of a great suspension bridge such as the Williamsburg Bridge across the East River, New York, a permanent lease of life, it is necessary to protect them absolutely against the weather. Not a drop of water nor any moisture-laden air must be allowed to get at the mass of many thousands of tautly strung wires which compose each cable. Otherwise, rust would set in and would be progressive to the point at which rupture would occur.

The Williamsburg Bridge has a main span across the river which measures exactly 1,600 feet from tower to tower. The bridge is hung upon four cables, each of which consists of 7,696 steel wires 3/16 of an inch in diameter. The diameter of each cable, as assembled, is 18¾ inches. When the bridge was being completed, now some twenty years ago, it was decided not to follow the method of protection adopted in the old Brooklyn Bridge, which consisted in wrapping the cables with wire. Instead, they were thoroughly soaked in a bituminous material and four wrappings of canvas heavily coated with the same material were wound around the cables. Outside of these was placed a sheathing of steel plate 1/16 of an inch in thickness. Now, in spite of repeated painting, this steel sheathing has corroded so badly that it was decided to remove it, together with the canvas wrapping, and substitute in its place a wrapping of 1/8-inch steel wire. Our photographs show the methods by which this work was done. The first step was to build a working platform beneath each cable. The platform is suspended by steel wire slings, one at each panel point of the main floor suspenders. These slings make fast to stirrups which hold a series of 8-inch floor beams, one at each panel point. Upon these are laid 3-inch by 12-inch longitudinal stringers, to which is nailed down the flooring of 2-inch by 12-inch planking. This construction affords a solid floor 8 feet in width, which gives ample space for the workmen to stand on each side of the main cable.

The wire-winding is done by means of the very ingenious automatic wire-winding machine, featured in our cover illustration and also shown in our engravings, which consists of a trolley-way, *B*, carried upon uprights, *K*, which are securely bolted to a series of saddles that are themselves bolted to that part of the cable which has already been wire-wound. Running in this trolley-way is a trolley, *C*, upon which is mounted an electric motor whose pinion, *D*, drives a large spur wheel, *E*, which is mounted upon and rotates around that part of the cable, *H*, which has not yet been wrapped with wire. It will be evident that since the trolley track and trolley are mounted rigidly upon the cable, the effect on starting the motor is to cause the large spur wheel to rotate about the cable as an axis.

Now upon the spur wheel is mounted a spool of wrapping wire, *F*. The wire passes from the spool over an idler, *G*, and then down to the main bridge cable. The spool, *F*, is provided with a friction clutch by which the desired amount of tension (500 pounds) is secured in the wire as it is wound around the cable.

In order to make a thoroughly water-tight joint where the wire winding meets the steel saddles, or clamps, from which the floor suspenders are hung, a special spur wheel is substituted for the one shown in our picture. This is provided with a tool rest, which holds a tool by which a recess is cut in the clamp deep and wide enough to admit four of the wire windings, which are thoroughly caulked in place with lead wool, thus preventing the entrance of moisture at this point.

After the old canvas protection has been stripped

(*Continued on page 400*)

Two of the Williamsburg Bridge cables, with the temporary working platform suspended below them. All four cables are being wrapped with 3/16 galvanized wire, whose total length is 960 miles

The Service of the Chemist

A Department Devoted to Progress in the Field of Applied Chemistry

Conducted by H. E. HOWE, Chemical Engineer

Degumming of Silk

THE *Color Trade Journal* has offered the following as a successful method for degumming silk:

"For fifty pounds of silk use two pounds of neats foot oil, one pound of olive oil soap, two ounces of washing soda and one ounce of salt. The salt and soda are dissolved in a small amount of clear water at not over 70° F. Boil the soap in twelve gallons of water until dissolved, then add the neats foot oil, stirring well to make an emulsion, then pour into sixty gallons of water part of which is the salt and soda solution. Keep this well agitated until the silk is put in; otherwise the oil will rise to the top, in which case it can never again be properly mixed. Thoroughly immerse the silk, which has been opened from the tight skein formation as taken from the "book," but not shaken out, and soak from eight to ten hours. Remove the silk from the bath and extract by whizzing in the centrifugal."

The Effect of Heat on Glue

THE Forest Products Laboratory in its experiments on ply-wood has determined the effect of oils and heat on glues used for such joints. The experiments included animal, vegetable, blood albumen and casein glues. Specimens were immersed in gasoline and various oils for a year, and tests at various intervals indicated to what extent the glues were weakened by this treatment. During the forty-five weeks' test the wood absorbed 60 per cent of its original weight in engine oil and 70 per cent of gasoline without any noticeable swelling of the wood occurring, while all glues weakened during the early part of the test. The total loss of strength in any case was so small as to be negligible under service conditions.

The experiments showed that continued heating will reduce the strength of animal glues and that a veneer glue lost one-half its joint strength during the first seventy hours of heating at 160° F. A lower temperature produces conditions favorable for bacteriological and chemical action, and the most favorable temperature is found to be 140° F. Even at this temperature long heating produces loss of strength. When open glue pots are used the loss in strength is apt to be concealed because of the increase in viscosity due to the evaporation of the water, but obviously such concentration is expensive and covered glue pots have a distinct advantage. Even with such pots long continued heating is to be avoided if high strength is to be maintained.

Selenium Oxychloride

AT the St. Louis meeting of the American Chemical Society last spring Prof. Victor Lenher, University of Wisconsin, announced that he had found selenium oxychloride to be an unusual solvent, the limitations of which had not yet been worked out. It was reported to be unusually good as a solvent for organic substances. Since then progress made with this material has justified the direction of the efforts of some twenty research students toward perfecting details of manufacturing the solvent on a large scale and also in making further determinations regarding its characteristics and reactions with a great number of substances. At present the indications are that in selenium oxychloride both the research and the technical chemist will find a new reagent of unusual value, and the refiners of copper will no doubt find a considerable outlet for their selenium in this direction. The effort to find further uses for selenium is being continued by a committee appointed for that purpose in the Division of Engineering of the National Research Council.

Some of the New Applications of Sulfur in Agriculture

THIS is the subject of an interesting article by Doctor J. G. Lipman in a recent issue of the *Chemical Age*. Doctor Lipman emphasizes the usefulness of sulfur as one of the ingredients of plant food, as a means for making available other plant food ingredients, and as a soil amendment. We are reminded that sulfur is one of the necessary ingredients if we are to have plant growth, the need for sulfur varying with the character of the crop. Cereals require from four to seven pounds of sulfur per acre each year and the legumes because of their higher content of protein need even more of the element. A fair crop of clover will require from eight to fifteen pounds of sulfur per acre and alfalfa may require more. A heavy crop of cabbage will need as much as thirty or thirty-five pounds of sulfur per acre. Much of the sulfur for crop food is supplied by the soil itself which contains from three to five hundred pounds per acre considering the soil to a depth of six or eight inches. The atmospheric precipitation provides from six to ten pounds per acre each year and larger quantities are washed out of the air adjacent to large industrial centers using sulfur-bearing coals. Notwithstanding this large amount of sulfur it is to be remembered that it is constantly being removed in the form of water soluble sulfates and by the crops themselves so that in time it will become necessary to replace it as is the case with any other essential in plant food.

In increasing the availability of other plant foods sulfur finds a place particularly in the manufacture of sulfuric acid used in the manufacture of potassium sulfate, ammonium sulfate, and the phosphate fertilizers. As a soil amendment sulfur acts to improve the texture of the soil and to correct excessive alkalinity.

The Chemist in Public Life

THE position of the chemist in our economic and political life still seems to be uncertain although many have believed that the war served to emphasize the importance of that profession. In a recent number of *Chemical and Metallurgical Engineering* an editorial called attention to the relative importance of cooks and chemists to the Civil Service Commission of New York City which had vacancies in the Service, one of which offered twenty-five hundred dollars per year for a cook and in the same list there appeared an opportunity for a chemist skilled in food and drug examinations for which the Commission was willing to pay eighteen hundred dollars per annum. The same list also included an opening for a laboratory assistant in pathology at nine hundred and fifty dollars per annum. Contrasted with this is the outcome of last year's Republican primary election for Senator in North Dakota where Doctor E. F. Ladd, a man prominent in the official Association of Agricultural Chemists and President of the State Agricultural College of North Dakota, was nominated, winning over the Senator up for re-election by over thirty-five hundred votes. Doctor Ladd has long been prominently connected with the enforcement of the pure food and drug legislation in his State, at one time fighting against tremendous odds. Doctor Ladd has also been prominent in work of sanitation and the author of a treatise on the analysis of paints. His election in November was more or less of a foregone conclusion.

Doubtless the chemists of the country will be particularly interested in Doctor Ladd's work and will feel that there is at least one member of Congress who will thoroughly understand their problems and be inclined to give them a complete measure of sympathetic consideration.

Decennial Celebration of the Forest Products Laboratory

A LARGE number gathered in Madison, Wisconsin, in July of last year to celebrate the decennial of the Forest Products Laboratory. The percentage of lumbermen and other business men willing to take their time to attend the celebration was encouraging as indicating an appreciation of the type of work which the Laboratory has carried forward these several years. Perhaps the most appreciative compliment lies in the fact that several foreign countries have used this Laboratory as a model in installing similar organizations who work upon their own problems. These countries include Canada, Australia, and Norway. The importance of forests to our national prosperity was emphasized at all the meetings as was also the necessity of fully utilizing the products of the forests. In outlining some of the future problems, Mr. C. P. Winslow, the Director, called attention to the desirability for a thoroughgoing study of glues and other adhesives to the end that smaller pieces of wood might be assembled in a way to make them satisfactory for use where much greater lengths and thicknesses are now specified. The Laboratory accomplished a great deal in this field while working upon aircraft and shipbuilding problems during the war.

Following the decennial celebration a conference was held on reforestation by the various wood-using industries in coöperation with representatives of the Federal and State forest services and the lumber producing interests. This program included a comprehensive presentation by W. B. Greeley, Chief Forester of the United States Forest Service, on what should be our national forest policy. The other items on the program discussed what has been done on reforestation, lumbermen's interest in the subject, and the reasons for the coöperation on the part of the wood using interests in reforestation. The importance of fire and its thorough control was especially stressed, fire being charged with from seventy-five to eighty-five per cent of the annual losses in the United States. The relations between the Federal, the State Government, and the private timber owner require considerable study if a satisfactory arrangement is to be obtained. Taxation is another perplexing problem.

Some of the points made in the conference were that we are cutting our forests four times faster than they are now growing, that there are in the United States three hundred and twenty-six million acres of cut-over forest lands bearing no saw timber, and that of our original forest area of eight hundred and twenty-two million acres only one hundred and thirty-seven million or less than twenty per cent remain as virgin forests.

Registration of Baking Materials

THE American Institute of Baking has perfected a plan for the registration of baking materials by which approved products will be given a certificate and a serial number, and so accorded recognition. At first this system will be limited to two lines of supply, namely, the malt product and the shortening agents. Later on, sugars, glucose products, yeast and yeast foods, salt, milk products and other raw materials for baking purposes will be certified. This plan grows out of the increasing number of requests received by the Institute for the analysis of raw materials, and the determination of their quality and adaptability to the particular purpose for which they are offered. These inquiries have come in not only from the baker but also from the manufacturer of the products who is anxious to know the exact quality of his own products and what may rightly be claimed for them. There has been such an increase in the variety and number of specialties offered the baker that it has been increasingly difficult for him to select the ones which have merit for his special purposes and to exclude others which do not meet his own requirements. While many products are of excellent quality the claims made for those which are not are sometimes not only exaggerated but false and misleading. The new plan should work to the advantage of the manufacturer as well as of the user and the public.

The Problem of the World's Supply of Energy

THIS is the subject of an interesting discussion by Doctor Arrhenius several months ago. It is pointed out that the early exhaustion of our fossil fuels will require the use of such other sources of power as water, wind, and sun. Doctor Arrhenius argues that the continual increase of carbon dioxide in the atmosphere will reforest the temperate zones and eventually drive civilization back to its birthplace—Mesopotamia, the Mediterranean, Central America and Peru. The estimated life of the coal fields is put down at fifteen hundred years and he believes it to be clear that we must soon ration our coal and substitute as far as possible other sources of energy. In view of the greatly increased uses of petroleum, it is considered doubtful that mineral oils will constitute an adequate auxiliary supply and the necessity for developing water powers as rapidly as possible is emphasized. The power from wind mills and solar energy is discussed from the standpoint of the limitations due first to the great variability of the winds and second to the geographic areas, choosing those where solar engines might be used to advantage because the sky is not covered over the greatest part of the year as in the Congo and the Amazon and the temperate zones.

Professor Arrhenius calculates that the increase of carbonic acid will give the whole world a more uniform and warmer climate. The burning of coal, therefore, will cause our climate to gradually approach that of the Tertiary Age. Agriculture will be benefited and reforestation will be stimulated.

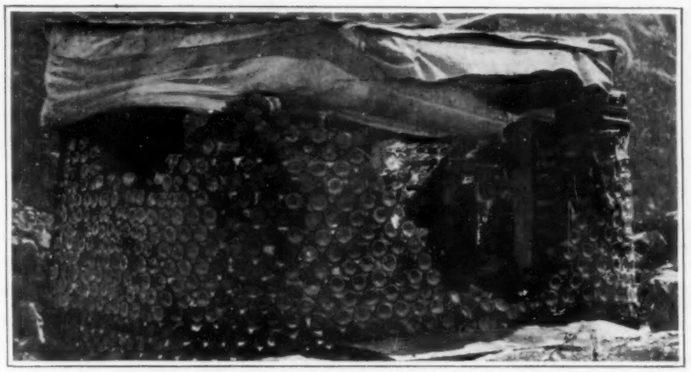
A Concrete Pit for the Garage Repair Man

ONE way to avoid the disagreeable business of squirming about on your back beneath a crippled car is to have a cradle of some sort on which to turn the car partly over, so that its underbody is exposed to the eye and hand of a workman in normal attitudes. What seems to be just as good a procedure, if not a better one, is found in a California garage from which the accompanying photograph comes. It appears to be borrowed from railroad and trolley repair-shop practice, where it is entirely the regular thing to have pits beneath and between the tracks for the convenience of the man who has to tinker with the parts of the mechanism that are not easily accessible from above. There doesn't seem to be any reason why the same thing should not be done in a garage, and here is one in which it is done. It will be observed that the fortunate worker in this pit, with his fan and his portable electric light, has all the comforts of home right at his disposal, as well as the comforts of a well ordered workshop as represented in his little workbench and vise.

A handy and well-equipped pit for working underneath the automobile

Those Who Live in Glass Houses

IN a land where everything except the climate and the scenery has to be brought several thousands of miles by ship and pack-train, it is a matter of obvious necessity that every little thing which is finally brought in in spite of these obstacles shall be utilized for all there is in it. This applies as well to packing cases and empty bottles as it does to their contents. So we have an ingenious Alaskan of Moosehead who instead of allowing his discarded bottles and those of his neighbors to go to the dump heap, has built him a shack of this unusual raw material. The photographer suggests that this looks as though there were no prohibition in Moosehead, and that if this is really the case, addiction to the juice of the grape is a real advantage to the proprietor of the mansion of the picture, to the extent that the more he drinks the sooner his house will be completed.



An Alaskan shelter built of empty bottles

Putting the Sound Where it is Wanted

A NEW YORK dance-hall proprietor who was having trouble with the acoustics of his establishment and experimented with a number of devices designed to make his orchestra properly audible to all his patrons, finally struck the right combination in a composition board shell, as shown in our picture. This sounding board is built in the shape of a huge clam shell, 21 feet wide and 13 feet high, and with a swell of 6 feet from back to front. It projects a foot and a half in front of the band-stand, thereby enabling the music to hit the shell and be projected from it without coming in contact with the ceiling, which it was determined had been the cause of all the trouble. Dancers in the most remote corners of the hall can distinguish clearly the sounds of the several instruments. Since its installation this sounding board has been inspected by many theatrical architects and builders in search of suggestions.

A thin sounding board shaped like a clam shell solved the acoustic problems of this orchestra

Saving Mine Timbers From Decay

ENORMOUS quantities of valuable timbers are being placed in the coal and metal mines of this country without any preservative treatment against decay. That the life of these timbers might be greatly lengthened by the injection of certain chemicals has been proved by the U. S. Forests Products Laboratory in numerous service tests. In 1910 the laboratory installed in an Alabama mine untreated timbers and timbers which had been treated with coal-tar creosote. Ten years later all the untreated timbers had been removed because of decay, while 80 per cent of the creosoted timbers were still sound and none had decayed to a point where removal was necessary. This is only one of the many records obtained by the laboratory which should induce every mining company to install some sort of wood treating plant.

At least three preservatives have been found suitable for mine work. These are coal-tar creosote, zinc chloride, and sodium fluoride. Creosote is the most effective in preventing decay. Timbers thoroughly impregnated with it are likely to resist decay until they are crushed or worn out. Occasional objection is made to the possible fire hazard of creosoted wood, but long experience indicates that the additional fire risk is very small. Zinc chloride and sodium fluoride are odorless, and if anything they tend to reduce the inflammability of wood. They are cheaper than creosote, and although they do not give such permanent protection they greatly increase the life of timbers. Coal-tar creosote may be applied by the brush, dipping, open-tank, or pressure methods. Zinc chloride and sodium fluoride may be injected by the steeping, open-tank, or pressure methods. The cost and effectiveness of the methods of treatment increase in the order given. The saving possible with any of them is so great that it will pay every mine to adopt the use of some preservative on permanently located timbers.

The machine which indicates the gentleness—or otherwise—with which the hairdresser goes about her task

White Yolks of Eggs

THE trick of obtaining eggs with white yolks has been turned, according to *Umschau*, by Palmer and Kempster, two poultry breeders.

The yolk derives its fine, yellow color from a natural dye, carotin, which also constitutes the pigment of carots. This carotin produces, as well, the intense yellow coloring in the beak, the earlaps and the legs of leghorns, an Italian breed.

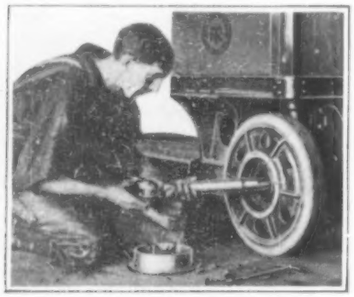
By eliminating all carotin from the feed it was possible to produce perfectly white leghorn hens, and these hens in turn laid eggs with white yolks; their fertility was not, however, limited in the least. The frequent disappearance of the yellow pigment from earlaps, legs, etc., which has been observed in leghorns during the laying period, is caused by the fact that during this time carotin is excreted, first of all, in the yolk. In the case of laying hens which produced eggs with white yolks, the carotin contents of the different feeds could very easily be examined. It proved that carotin is contained in greatest amount in Indian corn and in green feed.

A Testing Machine for Hair Combers

IS your barber in the habit of combing your hair in such style that the comb bites a piece out of your ear? Are his scissors afflicted with blunt regions, to have your hair caught in which means to have it pulled out by the roots? When he applies his massaging fingers to your face, do they feel like massaging fingers, or do they feel like a crippled plow working over a stony hillside? If the answers to these or any similar questions are to his discredit, perhaps you can persuade him to attend the school for hair-dressers which has recently been established in Berlin. At this place it is the aim not merely to teach the students what to do, but to instruct them thoroughly in the best way to do it. Our photograph shows, for instance, a test which they all have to meet before they are judged to be competent hair-dressers. This machine is specially designed to test the user's ability to comb hair without pulling or jerking or breaking it. By recording the tension at all times during the combing, it gives a complete indication of the manner in which the wielding of the comb progressed.

Inventions New and Interesting

A Department Devoted to Pioneer Work in the Arts



An electric truck in which driving shaft may be removed

An Electric Truck with Removable Driving Shaft

AMONG the several new features in a recently-introduced electric truck for factory transportation, is a removable driving shaft, as shown in the above illustration. This truck makes use of a single reduction worm drive. The motor drives the worm through a flexible coupling. The differential, the worm and the worm gear are enclosed in a cast steel housing. A four-pinion differential is used. The full floating driving axle may be removed without disturbing the wheels, for examination and repair. No weight is carried by the drive shaft, and ball-bearings are used throughout the power unit.

A New Idea in Canal Boat Haulage

SOME time ago we illustrated and described a novel type of electric mule employed in hauling the barges through French canals. More recently there has come to our attention the Cheneau system of electric haulage, which is now in use on the Saint-Maurice Canal and which, so it is reported, proves quite satisfactory.

Instead of resting on the ground, the Cheneau tractor is suspended from a stout cableway that parallels the canal. The weight of the tractor serves to give it the proper tractive effort on the cable, while a separate wire serving as a trolley wire supplies current, the return being through the cable. The Cheneau tractor weighs 1,320 pounds and is driven by a 10-horsepower, 500-volt motor completely enclosed in the case. Two vertical wheels rest on the cable and support the tractor, while four horizontal wheels, arranged in two pairs, serve to squeeze the cable and, being driven by the electric motor, form the tractive wheels.

This novel arrangement of the wheels and the towing cable has been figured out to such a nicety that positive traction is assured under all conditions. The motor is controlled from the barge, if desired, by wires running through the hauling cable.

Something New in Phonograph Motors

AN engineer in the large electric works at Fort Wayne, Ind., Chester I. Hall, has developed a motor to be used on phonographs, which meets all the requirements and which presents several interesting and novel features in design and operation.

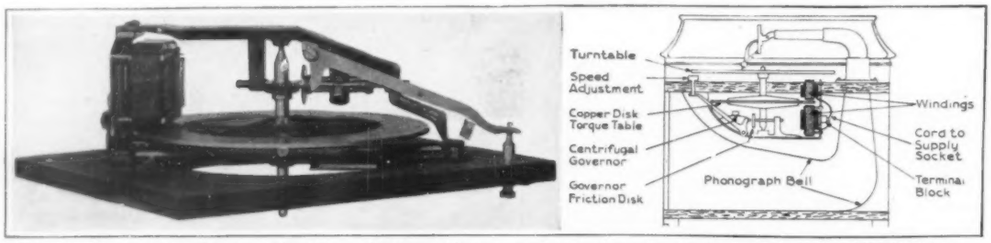
The motor is a small induction motor, somewhat similar to those used as the motive power of induction watt-hour meters. It consists of a rotating element fastened to the shaft of the turntable and running between two field coils. The rotor is formed of a ring of copper of about 6 inches inside diameter, and about 1½ inches wide, supported from the main shaft by a cast aluminum spider.

The rotor revolves through a shifting magnetic field produced by field coils wound on laminated magnetic circuits. Thus, since the revolving element is directly fastened to the main turntable shaft, all necessity for high speed gearing, belting or friction drive is entirely eliminated. The lower bracket supports a governor which is geared to the main shaft by a worm gear.

It was found quite difficult to eliminate the noise caused by the magnetic hum, due to the sixty-cycle circuit, but this was accomplished by a proper design of the supporting brackets and spider, as well as by the elimination of vibration in the motorboard itself.

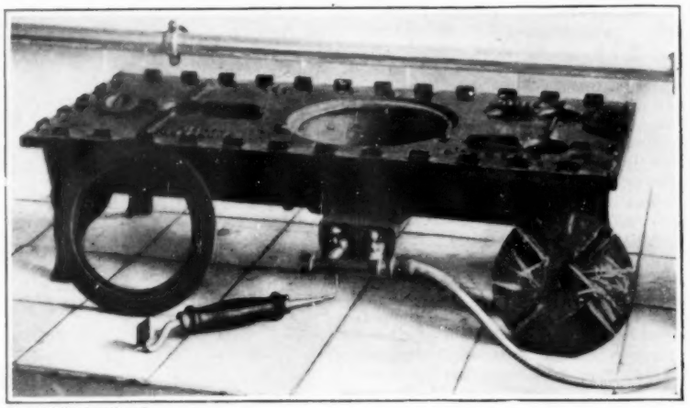
The simple construction, few moving parts—two only, as a matter of fact—the absence of sliding contacts and the small amount of power consumed in bearing friction, all combine to give the motor a life that is probably limited only by the life of the insulation.

If the claims made for this phonograph motor are substantiated in actual practice, it appears that this invention marks a distinct step forward in the phonograph art. Heretofore it has been well-nigh impossible to obtain a truly silent mechanical or electric motor, due to the fact that the high speed driving element has had to be geared down to the 78 turns, more or less, of the turntable.



Induction motor for phonographs, shown bottom side up, and the elements of this novel motor installed in a typical phonograph cabinet

Cheneau system of hauling canal boats in France. Note that the tractor in this case is suspended from a cable



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New gas stove developed in France and now being used because of its economical operation

A Gas Stove That Retains Its Heat

OWING to the high price of coal in France, illuminating gas is so costly that consumers are endeavoring in every way to curtail consumption. Indeed, the city of Paris recently held a fuel-saving exposition, to which manufacturers and inventors of stoves and cooking devices were invited in order that they might make their devices public.

The accompanying illustration shows a new type of gas stove which attracted no little attention and was the subject of favorable comment at the fuel exposition. It appears to give a remarkably economical performance. Instead of having burners in the open air, as is the standard practice, this new gas stove has its burners enclosed in a heating chamber lined with refractory brick. Openings are provided at the top of the heating chamber, so that pots and pans can be heated. In this manner the calories generated by the gas flame are not permitted to escape directly into the kitchen, but are directed against the pots and pans and thus made to do useful work. One burner serves for three or four pots and pans in this novel arrangement.

Clothes Pressing Reduced to Simplest Terms

IN order to facilitate the pressing of clothes in the average household, Jas. H. McManemin of Wilmer, Texas, has invented the simple device shown in the accompanying illustration. Pressing of men's suits, ladies' coats and suits, serge and other heavy dresses, and other garments in general is brought about merely by placing a piece of heavy wet ducking over clothes and resting device thereon. Current is then turned on, and the weighted electric heater left in place until the duck is dry. The pressing calls for no further attention, so that other household duties may be attended to while the clothes are being pressed into shape. The device weighs but sixteen pounds, is provided with handles, and measures 10 by 17 inches.

Weighted electric heater resting on wet duck covering and clothes to be pressed

Keeping Our Railroads Up to the Mark

(*Continued from page 384*)

of six is needed, while the triple unit calls for a force of ten. Four of these do the drilling, two take care of the bonding, one fixes the "bootleg" wires which connect with the source of current, and each of the cars has its operator. Even so, this is nine men fewer than are demanded when dealing with the same task by the more general method.

What is also decidedly suggestive, the air-driven drills are found to stand up to service with less frequent replacements and a smaller number of breakages. It is authoritatively said that in the case of the hand tool not more than 14 holes could be drilled on an average with a single drill, whereas the far better performance of the pneumatic apparatus means a saving in drills, in the course of a day's work, of something like $50. As a matter of fact, the 3-car equipment drilled 1,672 holes in the course of 7½ hours, and the single-car unit has made 730 three-eighth-inch holes during a span of a trifle more than 3½ hours. Indeed, neither of these bonding outfits could operate to capacity, for, on the occasions referred to, they were hampered by the slower advance of the rail-laying crews. In this we see the tables turned.

Pneumatic appliances are likely to do still more in the way of speeding up rail laying and making or maintaining the roadbed in a fit condition for heavy traffic. That is to say, air-driven wrenches are admirably suited for screwing up and tightening track bolts where the rails are bound together by fish-plates; and once the rails and ties are in place, the pneumatic tamper is of marked value in packing the ballast about the sleepers. So much superior is the air-tamper's work over that of the usual pick that an expert engine driver has declared that he can tell instantly when he is passing over a hand-tamped or a pneumatically-tamped roadbed. The latter, so it seems, gives a firmer support to the speeding train. Not only that, but the workman doing tamping with the pneumatic apparatus can accomplish more with less bodily stress. In part, this is due to his being able to hold an easy upright position, while when tamping with a pick he must bend over and keep his nose pretty close to the ground.

In conclusion, the portable compressor plant for railway work is equally useful in furnishing motive energy for pneumatic tools designed to drive screw spikes, to bore holes in the wooden sleepers, to drill through the rails in close quarters and awkward places, and to operate grinders for finishing off switch points. In all of these services the aim, of course, is to accomplish results quickly and with the least labor permissible. The fact that we possess these various apparatus is evidence that the roadways of our vital trunk lines can be rapidly whipped into shape to deal with the greatly increased volume of traffic which they will inevitably be called upon to handle before long.

Canada's Big Oil Strike

(*Continued from page 385*)

called it, is not uninteresting. Geologists have known of the existence of oil in the Mackenzie district for many years. Parties who went in to the Yukon by that route during the Klondike rush used to make use of oil shale for building their fires, and seepages were visible everywhere in the district, but it seems to have been to the tar sands that geologists looked as a source of potential wealth. A practical demonstration of the value of the tar deposits was made in 1915, when one of the Edmonton streets was paved with material made from the McMurray deposits. Just before the war Germany had become interested in the proposition, apparently with a view to securing an unlimited supply of tar for the benefit of the aniline dye industry. A number of German chemists visited the deposits, and one of them took out a lease, but he died on board ship on his way home; the war followed soon after, and put an end to German participation in the development.

The amount of tar sands available for reduction is estimated by the experts of the Department of Mines at billions of tons. The hindrance to their development has been the scarcity of fuel, but it is expected that this can be overcome by the utilization of natural gas, of which there is an abundant supply at the Pelican rapids, on the Mackenzie, 150 miles south of McMurray. An enormous volume of gas was burning there for over twenty years, and the Government had it capped a year or two ago. The recent advance in the price of crude oil has made the matter of reduction of the tar sands worthy of consideration. Another use which will probably be made of the tar from these sands is as a binding material for the coal briqueting industry which the Scientific Research Council is endeavoring to establish in the low grade lignite coal fields of the west. It is doubtful if any practical method of extracting oil from the tar sands on a commercial basis has yet been found, although the laboratory experiments have created great hope that one soon will be.

The most interesting phase of the new discovery for some time to come will be, as was the case with the Klondike discovery, the enterprise, romance, and danger connected with reaching the new fields. There are several alternate routes, as there were to the Yukon, each of which has its advocates and each of which will certainly have its patrons; but since the Yukon days a new factor in transportation has entered the field, and of this apparently some at least of the fortune seekers will take advantage. Airplane routes are being advertised and several aerial transportation companies are already in the field.

For the present, transportation will be principally by dogsled, as navigation will not be open until late in June. It is not expected that many will attempt to make the journey, however, until navigation opens. At the best, it is for part of the way a rough and strenuous trip, and under winter conditions is impossible to any but the most hardy and experienced. Some of the sour-doughs and hardy old mushers of British Columbia and Dawson City are said, nevertheless, to be preparing to make the long overland trek from that region.

With Edmonton as a starting point, there are several alternate routes, each of which will no doubt be tried as soon as navigation opens. The most direct is almost due north, the Athabasca route. Of this 290 miles is by rail, but a portion of the road is in very bad condition owing to muskegs, and presents difficulties. There is then a journey of 285 miles by steamboat, to Fitzgerald. The last stage is a sixteen-mile portage to Fort Smith, the head of steamboat navigation on the Mackenzie. From this point the distance is the same by whichever preliminary route is taken, or about 850 miles to Fort Norman, a total by the Athabasca route of roughly 1,500 miles. The Peace River route is two or three hundred miles longer, but is said to be the more speedy on account of the better and longer railway journey at the beginning. There is first-class railway accommodation to Peace River, 312 miles; thence the route is by steamer, with one short portage of four miles, in addition to the one of sixteen miles at Fitzgerald, common to both routes.

Motorizing the Rural Church

(*Continued from page 385*)

complished in this change is the fact that church membership is constantly increasing as the number of rural churches decline.

With the automobile came good roads,

(*Continued on page 397*)

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Recently Patented Inventions

Brief Descriptions of Recently Patented Mechanical and Electrical Devices, Tools, Farm Implements, Etc.

Pertaining to Aeronautics

AIRPLANE.—H. E. ROSE, 13 13th St., College Point, L. I., N. Y. An object of the invention is to provide for the foot control of the steering rudder, lift rudder and ailerons of an airplane, thereby enabling the pilot to have his hands free for any emergency; a more specific object being to cooperate in foot-controlled mechanisms with the usual hand lever, thereby giving an increased margin of safety in the event of injury to the pilot's arms or legs, or injury to the foot or hand control elements.

Pertaining to Apparel

COAT.—M. BERKWITS, 62 W. 14th St., New York, N. Y. The invention has for its object to provide a coat arranged to permit the wearer to wear it with either side out; in one position providing a plain exterior and when worn reversed presents a fancy appearance. Another object is to render the coat exceedingly strong and durable, and to insure a proper fit without danger of bulging parts.

SOFT COLLAR FASTENER.—M. W. REESE, 3216 Myrtle Ave., Omaha, Neb. The invention particularly relates to linked clamps for engagement with the meeting edges of the outer fold of a soft collar whereby said edges are secured together after the tie has been applied. The principal object of the invention is to prevent relative twisting of the clamps whereby to minimize the amount of time and effort required in the application of the fastener to a collar.

LOCKED SURFACE PIN.—O. KARTZMARK, 102 Richard Place, West Haven, Conn. The invention has particular reference to buckles, pins or clasps adapted to be detachably secured directly to the surface of a garment with an action somewhat similar to a cat's claw, the manipulation of the pin being readily effected by one hand. A still further object is to provide a pin or clasp for the attachment of elastic straps or the like for sleeves or hose supporters or other analogous uses.

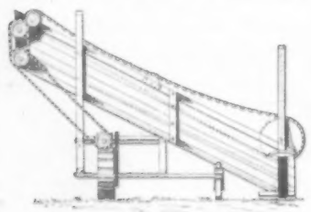
Electrical Devices

ELECTRODE TERMINAL. — H. M. KORETZKY, c/o Bright Star Battery Co., 310 Hudson St., New York, N. Y. The invention more particularly relates to dry batteries in which it is often difficult to provide a sufficiently tight contact to insure perfect results. The invention is especially directed to providing a terminal to be associated with a central electrode, such terminal insuring at all times an intimate contact between the active element and its body, whereby a full production of current will be insured.

COMBINED FEEDER AND MAGNETIC SEPARATOR.—H. CONVERSE, Winona, Miss. The object of the invention is to provide a combined feeder and separator especially adapted for use with cotton seed, grain or similar material, and which is adapted to be associated with the chute of any machine or system utilized to convey seed or grain, which is effective when so associated to control the feed of the fluent material, and to separate metallic particles therefrom.

Of Interest to Farmers

HAY ELEVATOR.—J. J WALLACE, R.F.D. No. 2, Huston, Idaho. An object of the invention is to provide a side-delivering hay elevator in which the hay or grain is taken from a side delivery rack device and delivered without waste to a wagon. Another object is to provide an elevator in which a pair of endless drapers are used to take and convey the load laterally of direction of travel and dump the same into a delivery wagon or receptacle.



A REAR ELEVATION OF THE DEVICE

PLOW.—A. AGNESI, Rome, Italy. This invention relates to a plow in which the point is made movable. The object is to produce a plow by means of which the plowing is facilitated owing to the fact that the breaking of the ground is effected by the movable point under the action of a blow delivered against the point supporting member, said blow being obtained by means of a set of rotable hammers mounted upon the plow frame.

SHEAF HOIST.—E. EBERLY and W. G. FRETROW, Mechanicsburg, Pa. The general object is to provide a sheaf hoist arranged with sheaf throwing means at the upper end of the hoist for taking the sheaves from the elevating conveyor and throwing them to a mow as well as with respect to other features including a novel means of mounting the hoist to be laterally swingable when desired through an arc to variously direct the sheaves to the mow.

A SIDE ELEVATION OF HOIST AS INVENTED

WEED CUTTING APPARATUS.—W. E. ARNATHY, Great Falls, Mont. The purpose of this invention is to provide an adjustable apparatus for cutting weeds in the field, the device having a plurality of cutting disks which travel in the ground in such manner as to be rotated by their coaction with the soil, thus eliminating the necessity of employing additional motive power for the propulsion of the disks.

GATE.—R. H. HEARN, Dyer, Tenn. This invention has for its object to provide a gate especially adapted for preventing the passage of stock when the gate is closed, and so arranged that it may be opened and closed from either side. The gate consists of a series of plates so arranged that they may be swung into the same plane, or in parallelism with each other together with means for operating the same and for holding the plates in closed position.

Of General Interest

CAMP STOOL.—B. C. Y. BROWN, 1155 E. Vernon Ave., Los Angeles, Cal. An object of the invention is to provide a collapsible camp stool, embodying features of construction, which tend to make the stool stronger and durable, yet light in weight. A further object is to provide a camp stool which is comparatively simple in construction and inexpensive to manufacture.

PHOTOGRAPHIC VIEW FINDER.—F. M. BARNEY, Elm Creek, Neb. The invention has for its object to provide efficient means for aiding the operator in symmetrically positioning the view or picture upon the film or plate. A further object is to provide a view finder for taking other than square pictures, in which the visible field presented by the view finder will correspond as regard to shape, position and proportion with the view impressed upon the film or plate.

ENDLESS TRACK GUN CARRIAGE.—E. RIMAILHO, 12 Rue de la Rochefoucauld, Paris, France. Among the objects of the invention is to provide a construction in which the apparatus for traversing the gun by hand is intimately connected with the service of the gun by the fact that the hand wheel is placed on the gun carriage near the sighting and elevating devices, to be worked by the same gun layer to simplify the operation of pointing the weapon.

DISPLAY DEVICE.—A. G. J. and H. B. DROSIN, 29 E. 14th St., New York, N. Y. An object of the invention is to provide a device which is adapted to be supported in the windows or doors of restaurants and like places to display the menu. A further object is to provide a device which is neat and attractive when in use, and which will permit of ready attachment and detachment of the menu card.

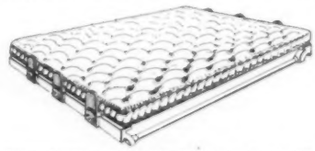
RAT TRAP.—T. V. CLAPP, 341 Main St., Springfield, Mass. The invention particularly relates to that form of rat traps which provide ready entrance to the trap, and which are so constructed that egress is made impossible, the door construction aiding in facilitating the entrance of an animal and effectively preventing its escape. A further object is to provide a trap which is strong and inexpensive to manufacture.

FISHING LINE.—T. BIRD, DECD., address Mrs. Hanna M. Bird, 29 Hubbard St., Cortland, N. Y. The invention pertains more particularly to lines of the water proof enamel type especially used for fly-casting. It is the primary object of this invention to construct a line which may be completely water proofed without liability to crease or break. A further object is to provide a line of greater strength than the ordinary braided type.

WINDOW GLASS PROTECTOR.—F. S. GILES, 575 Riverside Drive, New York, N. Y. The invention particularly relates to a device for use in connection with glass windows for preventing excessive vibration thereof, tending to shatter the glass. A further object is to provide a protector which may be readily applied in position and so constructed as to be readily adjusted to windows of different sizes, and to permit the cushioning member to contact with different parts of the window glass.

TIME-CONTROLLED DAM GATE. — E. KARNS, Jackson, Wyoming. The invention relates to controlled mechanism regulating the release for the out-flow of the dammed fluid at any desired time. An object is to provide a simple mechanism, particularly with respect to the means utilized to normally hold the dam gate closed, and capable of application to gates of various form.

MATTRESS HOLDER.—MARIANA T. JONES, 86 Rockview Ave., Jamacia Plain, Mass. An object of the invention is to provide means on a spring bed which will hold the mattress against slipping and which, when the mattress is removed can be folded out of the way so as to closely fit the spring bed. A further object is to provide such device at the foot and head of the spring body which will hold the mattress and prevent slipping, particularly in cases where the footboard or headboard is lowered.



A PERSPECTIVE VIEW SHOWING THE DEVICE IN POSITION

FUSE PLUG FOR GRENADES.—F. L. LE-BLANC, 48 Rue Lamartine, Paris, France. This invention is essentially characterized by two features: A special arrangement of the mounting of the detonator which insures its perfect concentricity with reference to the fuse cord and permits a simple, easy and rapid adaptation of this detonator to the fuse plug, and the provision of an insulating sleeve mounted in the interior of the body of the grenade, and in which the fuse plug is placed and fixed.

MOUTH CLEANING DEVICE.—J. L. KELLY, Aeolian Bldg., West 42nd St., New York, N. Y. An object of the invention is to provide a device which functions as a cleaning device for the teeth, gums, tongue and other portions of the mouth, and also functions as a massage device for the gums and is particularly adapted for use in the treatment of cases of pyorrhea.

Hardware and Tools

MASSAGE TOOL.—H. MALM, 2107 5th Ave., New York, N. Y. The invention relates to a readily portable device for the treatment of the skin and flesh; it pertains more particularly to devices of this character operating upon the vacuum principle. Among the objects is to provide a device for creating a vacuum in the presence of the skin or flesh of the human body in order to promote a healthy and vigorous condition thereof.

LOCK.—J. E. PHILLIPS, 260 Convent Ave., New York, N. Y. The object of this invention is to provide a construction which may be applied to any kind of a door, or device, at the same time resist opening and being tampered with, the lock including not only a bolt which may be projected and retracted, but a brace coacting with the bolt for resisting a jimmy or prying implement.

PUMP JACK.—S. C. CHRISTENSEN, Magdalena, N. M. The invention has for its object to provide a jack of the character specified especially adapted for converting rotary movement of a windmill, for instance, into reciprocating movement of a pump rod, with a minimum of side play. The wind wheel operated shaft is journaled in suitable bearings in a housing consisting of an upper and lower portion which are detachably connected.

SHADE AND CURTAIN HANGER.—J. W. JACKSON, Henrietta, Okla. An important object of the invention is to provide a curtain hanger or pole possessing a wide range of adjustment and at the same time a high degree of rigidity in any of its adjusted positions and which may be readily and easily assembled and mounted in position in connection with a window, door or other opening.

UNDERREAMER.—J. W. PIPPIN, c/o Pippin Mfg. Co., Oklahoma City, Okla. The invention has for its object to provide a device wherein the cutting bits are so mounted that they may be held in contracted position during the insertion of the reamer through the casing by latch mechanism, which is released when the bits have passed through the casing to permit them to expand.

SCRAPER.—J. B. KIRK, 2 West Buckanan, Iola, Kan. The object of the invention is to provide a cylindrical scraper which will be very effective in cutting carbon and other deposits from inside of distilling pipes. Another object is to provide a scraper which will resiliently bear against the inside surface of the pipes and will readily adjust itself to any irregularities in the surface.

COMBINATION FAUCET.—W. MEIER, 1951 7th Ave., New York, N. Y. The invention more particularly relates to a faucet which may be used for mixing hot and cold water in various proportions. One of the objects is to provide a single control combination fluid mixer of simple construction having relatively few parts and eliminating the necessity for the use of springs. The faucet may be used with equal facility either as a sink, basin, shower or bath faucet.

PATTERN AND GUIDE STRIP.—S. H. CALKINS, Webster Ave. and East River, Long Island City, N. Y. The invention has for an object to provide a device which will permit the ready depositing and pushing of plastic wall or floor coatings of a number of different colors without the various colors commingling, and also provide means for presenting a leveling or height controlling strip, which need not be removed after the work has been completed, and in addition will take care of the expansion of the material.

Heating and Lighting

THERMOSTATIC VALVE.—R. N. TRANE, c/o The Trane Co., La Crosse, Wis. This invention relates to thermostatic control for valves; its object is to provide a construction whereby the valve gate may be opened and closed easily and may be comparatively sensitive to changes in temperature. Another object is to provide a control which may be used on traps or other valves to open and close the same by a slight back and forth movement.

DRAFT REGULATOR.—C. W. MARDEN, Ridges Court, Portsmouth, N. H. An object of this invention is to provide automatic means for controlling the position of a damper in a smoke pipe in accordance with a draft. A further object is to provide a regulator which can be installed at a reasonable cost, and which will result in a saving of fuel, and maintain a fire at a predetermined rate of combustion, and will prevent overheating.

FURNACE WITH ROTARY GRATE.—E. ROMANET, 17 Rue de l'Elysee, Grenoble, France. This invention relates to boiler and other furnaces having rotary grates, the object being to provide a furnace of this kind the upkeep and attendance of which are easy while deterioration through clinkers is avoided, and regularity of draft through all parts of the grate is insured, as well as perfect combustion over the entire surface of the fuel.

Machines and Mechanical Devices

NUT BRANDING MACHINE.—T. S. SLIGH, 1843 Calvert St. N. W., Washington, D. C.

(Continued on page 398)

Motorizing the Rural Church

(*Continued from page 395*)

which made it possible for the farmer to attend churches many miles distant from his home with much less inconvenience than he had found in attending his little community church in former times. This change has brought about an increased social life, and has made possible flourishing community churches serving large populations. Those churches lacking in the elements which make for a larger and better social life in the community are doomed to disappear, and there is certain to be no great mourning over their loss.

The institutional church of today is demonstrating a capacity for work and service never dreamed of in the case of the old-fashioned rural church. It has adapted itself to the soil, and in many enlightened communities is serving as a community hall or center, where the social life of the neighboring country is developed along the most approved lines. The suspicion of heresy which was once attached to the fortunate owner of an automobile who persisted in riding about the country instead of going to church has long since given way to the realization that the fault lay with the church which had failed to find its true mission.

The important part the automobile has played in contributing to this change is explained by Statistician Baketell of the Methodist church in a report issued several years ago. "Almost every farmer in the Middle West," he says, "owns an automobile. When the family gets into a five- or seven-passenger car it finds it quite as easy to go five or ten miles to church as formerly to drive half a mile. Doing so, a larger number meet together; there is more enthusiasm, better business, better preaching and a larger social life. The effect is to shut the door of the white meeting house on the hill, just as it is, under similar conditions, to close the door of the red school house at the crossroads. The effect of the automobile is just beginning to tell upon church and school house, and I expect to see further material decreases in the number of churches and school houses."

In the State of Iowa more than 1,200 rural churches have disappeared in the last twelve or thirteen years, and this number is constantly increasing. Approximately 10,000 of the little white meeting houses have closed their doors in the Middle West farming belt in the last decade, and rural life experts and church leaders do not expect to see this movement halt until thousands of others have joined this constantly increasing number.

The tendency of fifteen and twenty years ago was to overchurch the average rural community. The average rural community of 500 had from three to five churches within its borders and a scattering of small meeting houses in the surrounding country. It seems a miracle that any community, however prosperous, could have supported so many churches, so many of which had failed utterly to take root in the soil and apply themselves to the betterment of the social life of the country. This waste of resource and effort required to keep these churches going represented a most important drain upon the more active churches throughout the country, and there is no regret in this passing of the old order.

The old-fashioned church has given way to the community or federated church in which all denominations and interests may gather for religious worship and greater social progress. The church has truly become an institution of service. It has given root to what is known as the "corn" preacher, one who knows and loves the soil and who is able to meet the farmer on his own business level. He can talk corn and crops intelligently from the pulpit or in the field and can apply the lessons of the Bible in terms of farm life. This spirit is emphasized by the young country minister who declared: "If I cannot talk intelligently to the members of my congregation about the principles of good farming, I am not fit to serve them." This minister left his school to spend some months studying advanced farming in a nearby college, and he has succeeded in making his church one of the model rural houses of worship of the country.

Instead of moving to the city when their active days on the farm are over, the farmers are finding it more satisfactory to move up nearer the community church as a means of keeping up the social life developed under the new regime. This has resulted in the founding of many small rural towns, and is pointed to by church leaders and rural life experts as one of the pleasing compensations for the loss of the old-fashioned church. The young people who formerly motored to the nearby city for the Sunday services now park their cars before the community church, the old wagon sheds having been displaced in many instances by modern, sightly shelters for motor cars. It is because of this tendency that the churches are not alarmed at the rapid rate in which the little white church of the past is disappearing.

Fuel Conservation Opinions—II

(*Continued from page 386*)

Should We Have the Super-Power Zone or Not?

One authority, the American Engineering Company, rather questions the value of grouping power plants into single large power groups. There are, of course, many sides to this question. While economies can be effected by means of this grouping up to a certain point, this point is practically reached under present conditions in the large stations in such centers as New York, Philadelphia, etc., holds this authority. The grouping would result in long transmission lines, and some real difficulties in distribution. Power plant equipment, continues this authority, becomes obsolete very rapidly. New developments are so rapid that a present modern large power station does not represent the best performance when it is completed at the end of two or three years of construction. In the so-called super-power stations this condition would not be improved. There is, at the present time, undoubtedly a substantial element of competition between the largest and highest types of power stations that leads engineers to investigate and develop new types of apparatus which, to a very considerable extent, would be eliminated by grouping.

A similar opinion is expressed by Mr. Frank S. Frost, Superintendent of Power of the New Orleans Railway and Light Company. He believes that with the demand for power, as it is in his section of the country, especially since the cities demanding a considerable quantity of power are widely separated, there is no call for so-called super-power zones. Mr. Stuart Cooper, Manager of the Charleston Consolidated Railway and Lighting Company of Charleston, S. C., concurs in this view, stating that the super-power zone idea will be a proper procedure only as the concentration of population permits. Thomas A. Edison states that he "does not think our water powers have been utilized enough at present time to make grouping very attractive."

So all in all it would appear that the negative side of the super-power zone controversy is based on present, rather than future, conditions. Several authorities tell us that the super-power zone idea will be evolved automatically as the need arises for such a measure. Thus as the cost of power produced from bituminous coal in individual plants increases, due to the exhaustion of the more cheaply mined bituminous coal acreage, it probably will become more economical for the small power plants to discontinue making their own power and draw it from larger power groups, or so-called super-power

(*Continued on page 399*)

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RECENTLY PATENTED INVENTIONS

(Continued from page 396)

More particularly this invention relates to a machine for stamping and marking walnuts and other small articles, the main object being the provision of a device which will place a distinguishing mark upon articles readily and efficiently. A further object is the provision of a device wherein the motive power is derived either wholly or in part from the article to be stamped, and from the impact of the article after it has fallen under the influence of gravity through a predetermined distance.

DESICCATING MACHINE.—G. C. CONTANT, 308 W. 70th St., New York, N. Y. The invention has for its object to provide a simple construction whereby liquid or semi-liquid may be desiccated, and wherein through the use of vacuum a minimum heat is necessary to produce the proper drying action. A further object is to provide a machine in which a traveling belt is used with means for spreading the material thereover, the parts being so arranged that a large quantity may be desiccated in a minimum time.

TOOTHPICK DISPENSING DEVICE.—J. E. KENKEL, Great Falls, Mont. An object of this invention is to provide a device which will present a single toothpick and which, when said toothpick is removed will be operated to permit another toothpick to fall into position for removal. A further object is to provide a device which will dispense toothpicks from their original package, which will be entirely sanitary, and especially adapted for use in public places.

EVAPORATOR. — T. M. PUSEY, Kennett Square, Pa. The invention relates to evaporators and more particularly to an apparatus for evaporating water out of zinc-chlorid or out of alkali solutions or the like. An object is to provide an inside partition or sleeve within a vacuum kettle, forming an annular chamber between the walls to cause the solution of zinc-chlorid to circulate and prevent uneven or sudden forming in the main mass as well as to expedite the evaporation. A further object is to utilize the heat of the water of condensation from the steam jacket surrounding the kettle to assist in producing a circulation of the solution being treated.

CALCULATING MACHINE.—J. M. BRANDVEIN, 754 E. 151st St., New York, N. Y. An object of the invention is to provide a small and compact portable device which can be conveniently and quickly operated to find an unknown factor when other factors are known. A further object is to produce a simple construction which is not liable to get out of order and which can be operated by any one of average intelligence to ascertain quickly factors which heretofore have required considerable mathematics.

ATTACHMENT FOR PUNCHING MACHINES.—C. S. NELSON, Little River Road, Quebec, Canada. The invention has for its object to provide an attachment for permitting openings to be punched in work at predetermined points without the necessity of laying off said openings with a templet or the like, wherein a carriage is provided having guided movement with respect to the punch, and having means for clamping the works to feed the same to the punch and properly position the work.

AIR COMPRESSOR.—C. M. TURSKY, 270 Willis Ave., Bronx, N. Y. The invention relates to an air compressor embodying a revolving element and a double ended floating piston; the invention resides in various novel features including the air ports, means for actuating the pistons, and the lubrication system, whereby the lubricant is circulated through the piston for cooling, and effectively distributed to the bearings.

TAMPING ROLLER.—M. M. EMERSON, 408 Gatzian Bldg., Pearl St., Ellensburg, Wash. The object of the invention is to provide a tamping roller which will be effective to completely tamp and roll, the entire surface being acted upon and which is of simple and durable construction, reliable and efficient in operation, and easy and inexpensive to manufacture.

GAGE.—R. G. BLOXSOM, 403 S. 7th St., Camden, N. J. Among the objects of the invention is to provide in a single gage means for recording both pressure and vacuum, to provide a gage with a stationary dial containing a scale indicating vacuum and having a movable pointer registering therewith, and also to provide a movable dial having a scale registering with the zero mark or pointer of the fixed dial to indicate pressure.

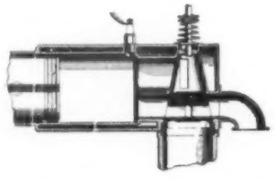
BINDING MACHINE.—W. T. WEAVER, Route 4, Highland, N. Y. This invention relates to the photographic industry and more particularly to that branch devoted to the manufacture of lantern slides for use in projecting machines. The object is to provide a machine for binding the sensitized negative and the cover glass by use of adhesive strips; a further object is to provide a machine which will correctly apply the adhesive tape in a perfectly regular manner around the edges of the two glasses thus forming a single unit.

Musical Devices

PIANO KEY REPAIR CLAMP.—E. R. CRANDALL, Coldwater, Mich. Among the objects of this invention is to provide a clamp for holding the ivory veneer of the piano key while the glue is setting, the clamp being designed for and permitting the head piece and front piece to be clamped in position, at the same time, and without removing the key, and thereby saving much time and labor.

Prime Movers and Their Accessories

ROTARY VALVE.—H. T. DUTTER, Albuquerque, N. M. This invention has reference to internal combustion engines and more particularly to a rotary valve structure for controlling and tuning the inlet of the gaseous fuel charge or mixture to the cylinder of a motor and the discharge of the exhaust or



SHOWING A SECTION OF GAS ENGINE EQUIPPED WITH THE DEVICE

burned gases therefrom, the construction being such as to require few parts, thus reducing the cost of production and maintenance, and permitting operation indefinitely without regrinding or resetting valves.

IGNITION SYSTEM FOR INTERNAL COMBUSTION ENGINES.—A. P. RIEDELLE, St. Cloud, Minn. The invention relates particularly to a device for indicating whether or not the several spark plugs of an engine are properly sparking. The purpose is to provide an indicator which can be placed on the instrument board of an automobile, such device being capable of application to any standard ignition system without radical changes therein.

ROTARY INTERNAL COMBUSTION ENGINE.—H. O. NEEBE, 601 W. 190th St., New York, N. Y. This invention has for its object to provide a rotary internal combustion engine arranged to subject the rotor to a plurality of impulses at each revolution of the rotor, thus rendering the engine exceedingly powerful without requiring an undue increase in the dimensions of the engine.

Railways and Their Accessories

RAILWAY SWITCH OPERATING DEVICE.—F. G. SMITH, 366 Park St., New Bedford, Mass. An object of the invention is to provide switch-operating mechanism, parts of which are installed on the car, and parts in the track pit so the engineer driving a train may automatically throw the switch tongue for switching his train upon a side track, or directing the train forward on the main line without stopping the train.

SMOKE CONSUMER FOR LOCOMOTIVES.—B. H. THOMAS, Clifton Forge, Va. The foremost object of the invention is to provide means applicable to the boiler shell of a locomotive in any convenient position, for admitting air in a volume which is capable of being adjusted for the purpose of supporting the combustion or aiding in the consumption of the discharged gases and unconsumed particles so as to practically eliminate smoke.

CAR MOVING DEVICE.—H. B. WEISS, Box 14, Binghamton, Tenn. Among the objects of this invention is to provide a car moving device capable of being transported from place to place and carrying means for engaging a car and drawing the car toward the said device, and having means for anchoring the device to the track.

VALVE.—H. MIGUES, New Iberia, La. An object of the invention is to provide mechanism in connection with the angle valves of air brake systems, for automatically setting the brakes behind the valve, when said valves are closed or partly closed, giving the engineer full control of the brakes above the said valve and for relieving the pressure in the air hose when the cars are cut off, both valves being closed, thus permitting the trainman to break the connection with ease.

INDICATOR MEANS FOR CAR SEATS.—N. J. RYAN, 51 Main St., Tuckahoe, N. Y. This invention has for its general object to provide an indicating means adapted to be secured to the back of a car seat or other suitable support, mechanism arranged to be controlled by the conductor, and to be set by him upon payment of a fare, in a manner that he may upon approaching the seat, inform himself at a glance respecting the destination to which an occupant of a seat may be entitled to be carried.

Pertaining to Recreation

AMUSEMENT DEVICE.—D. BIRD, 266 W. 128th St., New York, N. Y. Among the objects of the invention is to provide a game in which use is made of an inclosure having a pocket and in which a plurality of buoyant bodies are arranged and subjected to the action or air force impelled therethrough to seat and retain one of said bodies in the pocket, the arrangement being such as to obviate the necessity of manually removing the seated body from the pocket.

AMUSEMENT AND EXERCISE APPARATUS.—J. W. E. DEAN, 29 Cornelle Ave., Yonkers, N. Y. The invention relates to an apparatus adapted for use either by a single person or by more, and in which may be employed a ball or balls, and a receiver into which a ball may be thrown by the player and from which it will be automatically discharged in a direction to permit of its being caught by a player so that the ball may be returned to the receiver as rapidly as discharged.

AMUSEMENT DEVICE.—O. V. BORGESON, 5017 6th Ave., Brooklyn, N. Y. The principal object of the invention is to provide a device which is in the nature of a game requiring a certain amount of skill and in which the element of luck is only a secondary part. Another object is to provide a device simulating a race course over which a plurality of racing bodies are adapted to be moved between a "starting point" and a "goal," each of said bodies being under the direct control of one of the participants of the game.

INDOOR GOLF COURSE.—G. SOCHUREK, 55 6th Ave., Astoria, L. I., N. Y. The invention has for its object to provide an indoor practice tee, whereon driving may be practiced with the same energy and skill as if the player were operating outdoors. A further object is to provide a taut sheet which the driven ball strikes and wherein an indicator operates to indicate in proportion to the blow of the ball, and to register the distance of the respective drives.

AMUSEMENT DEVICE.—S. W. GASS, Carr Apmt., Antralia, Wash. This invention contemplates the construction of an amusement device, consisting of a sled or toboggan, fitted with wheels, and inclines which permit coasting at any time of year and in any climate. The device is designed to prevent accidents in coasting by protecting all movable parts with covering, so that no one can come in contact with the moving parts while in operation.

ROLLER SKATE BRAKE.—A. ICKENROTH, R. 1, Box 132, Clayton, Mo. The invention has for its object to provide a brake of the character specified, by means of which the user may control the skates, to move slow or fast as may be desired, without interference with the free movement of the legs and arms of the user. The device may be applied to any roller skate.

Pertaining to Vehicles

TIRE RIM.—E. ACHA, c/o Mr. Lake, 135 Front St., New York, N. Y. The primary object of the invention is to provide a tire supporting rim which will greatly facilitate changing an incapacitated tire for a perfect one without the usual labor. A further object is to so construct the rim that it may be manufactured relatively cheap, at the same time rendering it capable of carrying out its use with the greatest efficiency.

WINDOW.—W. S. SHIELDS, R.F.D. No. 1, Yardley, Pa. The invention has for its object to provide mechanism in connection with sliding window sashes, especially adapted for use with automobile buses, trolley cars, railroad coaches and the like, for making a close fitting joint between the sash and the window frame without the possibility of sticking, and which will compensate for wear.

INNER TUBE CARRIER.—J. M. MILLS, c/o State Nursery and Seed Co., Helena, Mont. The object is to provide a carrier preferably made of sheet metal, including compartments and drums rotably mounted within the same, and pairs of rollers movable toward each other, and adapted to bear against opposite sides of the tubes upon their being coiled around the drum, with a view to avoid vibration and thus deterioration of the tube.

WHEEL TIRE.—O. HOPKINS, c/o Rose Hopkins, Argusville, N. Y. The particular purpose of the invention is to provide a device of the character specified possessing certain mechanical advantages, among them being resilience, reduction in liability to puncture, and the prevention of one part of the tire from shifting laterally in relation to another part. The device comprises an inner annular member and an outer annular member with springs, anti-friction balls, and other mechanism carried by the outer annular member.

TRANSMISSION.—O. S. PULLIAM, Room 2528, Park Row Bldg., New York, N. Y. The invention pertains more particularly to a gear set especially adapted for transmission of power in motor vehicles. An object is to provide mechanism in which a direct connection is established between the driving and the driven members when it is desired to transmit the power at high speed, and in which the direct connection may be broken when it is desired to drive at low speed or in a reverse direction.

ALARM.—C. E. MULLER, 568 W. 173rd St., New York, N. Y. The object of this invention is to construct an alarm particularly applicable for use in connection with automotive vehicles. Further objects are the construction of an alarm which shall be entirely accessible to the operator of the vehicle for the purpose of "setting" and "releasing," and which shall be extremely simple in its parts and economical in manufacture, and so constructed that it will be impossible to move the vehicle without operating the alarm signal, when the latter is set.

SPRING SHACKLE.—E. L. BALL, Alexandria, La. This invention has for its object to provide a shackle of the character specified, designed to prevent the usual noises attendant on the use of the usual type of shackle, wherein a specially designed roller-bearing is substituted for the usual bolt and bushing. All end thrust is taken up by the rollers. The outer race is adjustable without the necessity of dismantling the assembly.

VEHICLE TIRE AND RIM.—F. M. HENRY, 201 Landis Ave., Vineland, N. J. The invention relates more particularly to motor vehicles. An object is to provide means for loosening the tire sections when it is desired to remove the same. A further object is to simplify the construction of tire sections without detracting from the advantages of the same or adding to the expense of manufacture.

Designs

DESIGN FOR AN ARTICLE OF MANUFACTURE.—M. WILNER, 44 White St., New York, N. Y. This inventor has been granted two patents.

DESIGN FOR A RING.—M. SIMSON, 125 Canal St., New York, N. Y. The inventor has been granted two patents.

DESIGN FOR A GLOVE.—H. I. SEELY, 450 Penn Ave., Waverly, N. Y.

DESIGN FOR AN ARTICLE OF MANUFACTURE COMPRISING A FLOUNCING OR EDGE FOR FABRICS.—H. T. MENDELSOHN, 40 W. 25th St., New York, N. Y.

DESIGN FOR A DOLL.—JOSEPHINE M. COOK, Brookville Crest, Clinton Ave., Plainfield, N. J.

DESIGN FOR AN AUTOMOBILE WHEEL LOCK.—L. E. TRIMM, 465 E. 29th St., Brooklyn, N. Y.

DESIGN FOR A BUTTON.—J. FOX, 49 W. 24th St., New York, N. Y.

DESIGN FOR A COSMETIC BOTTLE AND MASSAGE DEVICE.—J. O. LINDEN, Box 668, Albuquerque, N. M.

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Fuel Conservation Opinions—II

(*Continued from page 397*)

zones. Already power plants are being located at the mines, so as to eliminate the transportation of coal, and serving to distribute electric power to the erstwhile coal consumers over quite an area. Again, small power plants in thickly populated sections of the country are gradually becoming substations of larger plants. Indeed, there are ample signs that the super-power zone idea is gaining ground, automatically and without attracting much attention, to be sure.

The Fuel and Power of Tomorrow

Speaking of new fuels and sources of power, it is interesting to learn that Californian power plants have recently been offered a new fuel—crude oil residue—produced by the oil companies from fuel oil by breaking the crude oil down into its constituents to a greater degree than has heretofore been the practice. The problem of suitable storing and firing methods for this new fuel is at the present time being studied. The quantity of its supply is limited, since it will be a by-product from the distillation of crude oil.

Several large users of fuel are watching with interest the development of powdered fuel and colloidal fuel, which is now going on; but it is difficult to obtain a definite opinion as to the probable future of these fuels.

Lignite, even of the low grade North Dakota variety, will undoubtedly be more generally used in the near future, we are told by other authorities. Heretofore stoking equipment had not been developed that would burn the lignite satisfactorily, but the advent of recent automatic stokers has provided a means to utilize this cheap, low grade fuel, and an increased use of lignite can be confidently expected.

Our attention is directed to the great possibilities of obtaining higher efficiency from the fuels now used and the saving of the by-products, as well as the expanding area of oil-producing sands and shale; also, there are possibilities for methyl alcohol and other fuel products. Indeed, if we grasp the idea of certain authorities correctly, it would seem that we are only at the doorway of Nature's storehouse, and that we might well learn first to make the most out of our present fuels before we seek new varieties. There is little doubt but that we shall be using powdered coal and gasified coal in ever-increasing quantities in the not distant future, after first extracting the valuable by-products, thus substantially reducing the cost of the fuel by obtaining certain by-products that are not permitted to go to waste. But before much progress can be made along these lines, the problem as a whole should receive considerable publicity and no end of study.

Edison suggests that the volcano and hot spring areas in the United States might give considerable power by means of deep bore holes and turbines. This scheme, it will be recalled, is in successful commercial use in Italy.

But it is a fact that human nature never seeks a definite solution of a problem until the problem becomes acute. There may be exceptions—Germany's development of her brown coals is an example, a very rare and worthy example, it goes without saying; but as a general thing the users of fuel are content in the assurance that of bituminous and anthracite coals, of petroleum and the lighter oils, of alcohol and of natural gas, and of all the other fuels which we are using today, there is an ample supply for many years to come. Hence the prevalent implied attitude. Why worry?

Farming with Electricity

(*Continued from page 387*)

phase iron. The connected load is 250 kilowatts, which is carried by 200 kilowatts of distribution transformers. The maximum use of energy occurred in April, 1920, when 10,920 kilowatt-hours were delivered from the substation to the company's feeders with a recorded maximum demand for 35.2 kilowatts.

The housewife shares generously of the benefits accruing from the application of electrical labor-saving devices on these Idaho farms. Many homes have been constructed without chimneys; electricity serving the purposes of illumination and heating, as well as the operation of the washing machine, sewing machine, and cooking appliances. Even the offspring of Mother Hen is warmed by current generated from the power plant, a carbon-filament lamp being installed in the chicken coop. Electrically-driven pumps supply water to the homes, and the farmer hooks a motor to a jack shaft, which drives the pump, cream separator, grindstone, feed grinder, and other useful machinery. The electric iron enjoys almost universal popularity, there being 1,862 flatirons in use. The washing machine is operated by electricity in 875 of the homes of the rural consumers. Vacuum cleaners, curling irons, ranges, moving picture machines, coffee urns, percolators, fans, water heaters, adding machines, vibrators, bake ovens, sterilizers, air warmers, and heater pads are among the electrical appliances in use. Seventy per cent of the residents on this Government project being owners of sheep, electricity for pumping water to the stock minimizes labor requirements. All told, 5,141 electrical appliances are in use, their popularity being represented by a 54 per cent increase within twelve months.

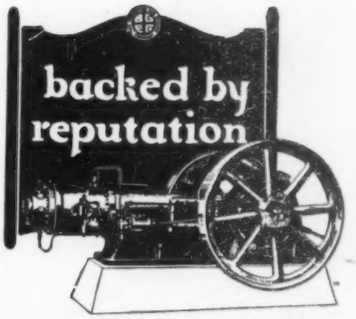
When Oysters Are in Season

(*Continued from page 388*)

from New York and New England to foreign countries involves the use of barrels containing three bushels and one-half peck, the container having a head. Hotels and restaurants serve oysters on the half shell, the "Blue Points" from beds of a cape on the south side of Long Island enjoying a distinction when thus placed on the menu. Likewise oysters are shipped in the shell from eastern waters to the Pacific coast for propagation purposes.

Shucking is described as the process of divorcing the meaty contents from the shells, tables or stalls in oyster houses being assigned for the separation proceedings. The water products are conveyed to the tables by wheelbarrows, in small establishments. In more pretentious oyster houses, the oysters are first taken to a storage room and let down through chutes to the individual stalls of shuckers. The operator stands on a bench before the table, upon which the shell fish tumble from the descending movement through slanting chutes. Blocks are accessible for placing the oyster for opening. Skill and muscle power are requisites for shucking. A mitten is worn on the left hand to avoid contact with the knifed edges of the shell, the hand of the shucker moving with incredible speed. A knife is used in prying the shell apart. From ten to twelve gallons constitute a reasonable day's work. The meaty contents are deposited in a galvanized-iron container, while the shells gain admittance to a trough in the shucking table whence they are transported for concentration by a mechanical carrier. The meat of the fish may be then robbed of its excess fluid by perforation. In small oyster houses the shells are deposited on the floor alongside the shucker and later removed in wheelbarrows. A movable wooden stall, 18 or 20 inches wide, quarters the operator and protects him from the accumulating mountain of shells. During the season of 1919-1920, shuckers were paid from thirty-five to forty cents a gallon.

Once deprived of their shell-enclosed home, the meat of the oyster is placed on washing tables. Simple in construction, these units are made of galvanized iron, measuring 5 feet long and 2½ feet wide, and supported on a wooden framework. Water drainage is effected through a per-



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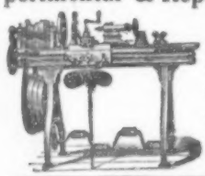

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forated bottom. A series of washings is administered, fresh water usually being applied. The legislation of some states, however, makes it obligatory that salt water of a specified strength be used as an agency in forestalling bloating by the absorption of fresh water. Oyster houses having necessary facilities administer a preliminary washing on tables and then convey the oysters by a lazy-flowing stream of water down runways to tanks on a lower floor. Here, two washings are given them, not unlikely compressed air being blown from pipes through the water containing the products of the Chesapeake Bay.

Oyster canning as an industry has developed rapidly within recent years, 15 canneries being in operation in Baltimore. Georgia, Mississippi, South Carolina, North Carolina, Louisiana and Florida, maintain 18, 16, 12, 7, 7, and 5 canneries, respectively. Not unlike raw oyster houses, canneries have wharf frontages where the products of the waters may be conveniently unloaded. Huge tubs or buckets are the receiving containers, these being dumped immediately into cars 10 or 12 feet long, made of iron strips, fashioned like baskets. The cars are moved on a track into the cannery, some of these diminutive trains carrying 15 cars with 20 bushels of oysters to the car. The cars terminate at a junction of rectangular iron steamers, which accommodate three units simultaneously. Steam is passed through them for three to ten minutes. The train load is moved to the other end of the steamer, where the oysters are opened directly from the cars by shuckers. A metal bucket, suspended by a hook from the side of the car, is the container for each shucker. These buckets are perforated, admitting seepage of excess liquor. A knife is used in separating the shells from the meat, an easy task after the steam has been applied. When a bucket has been filled, the oysters are weighed, the shucker receiving payment according to weight. From the weighing scales, the shelled products are washed two or three times in vats or on tables, whence they are conveyed to a packing table. Structurally, this table is of wood and is 12 feet long and 6 feet wide at its widest area and 3 feet wide at its narrow portion. Women and girls do the packing, empty cans being available from boxes located near by. The cans have a capacity of three to ten ounces. A belt carries them along a trough under a leaking pipe from which hot brine is deposited in the cans. The same belt forms connection with the capping machine, the latter crimping covers at a rate of 58 cans to the minute. Having tacitly said goodbye to the capping machine, the cans are cornered in roomy circular iron baskets, four feet across, and lowered into a cylindrical metal processing tank. The cans are subjected to steam at high temperature, shortly being removed and lowered into a circular wooden tank or cooler. Running water is the cooling agent. Baskets of cans are wheeled on tracks to the labeling and packing room, where labels are pasted, and forthwith the finished product is packed in boxes.

Crushed shells are relished by chickens, the product first being dried in a direct-heat rotary drier. The percentage of moisture in the shell is the determining factor as to the degree of heat to be applied—the greater the moisture content the higher the temperature. The regulation of the latter is all-important, as the shells may be deprived of their virtue by excessive heat. A crusher is used for pulverizing the material, a revolving screen separating the crumbled material with respect to various grades. Oyster shells, as road-building material, may be partially crushed or placed on the highways in their entirety, letting the abrasive action of traffic do the work. The excessive acid in farming lands may be relieved by lime produced from shells. They are burned in a kiln, the interior of which is cone-shaped at the bottom. An elevator deposits the shells in the kiln, a bit of fine coal being mixed in as fuel. The fire burns constantly, and the burned material is shaken through the grate at the bottom. The product is permitted to air-slake, the lime being sold for $8 a ton.

A Stride Forward in Electric Welding

(*Continued from page 389*)

so good; but now for the really distinctive features of the process—the agencies provided to get rid of impurities and to promote deoxidization while shielding the incandescent deposited metal from contact with the air. The welding wire, no matter what its composition, is immediately surrounded by a jacket of aluminum, and outside of this is an envelope of blue asbestos. In the flame of the arc, the aluminum commingles with the material of the melting rod and cleanses it before that metal is condensed and deposited at the point desired, and at the same time the fused asbestos forms a cloaking slag which remains atop the accumulating metal. This asbestos layer holds the atmosphere at bay on one side and checks the escape from beneath it of the momentarily vaporized carbon, silicon, manganese, etc., which may characterize the steel's make-up. These several actions go on automatically, and the welder has only to guide the electrode and to bring the operating current into service at will. The asbestos slag is easily got rid of when the weld has chilled because the stuff is brittle and readily detached by a hammer blow.

It seems that the quasi-arc weld requires less deposited metal to produce a satisfactory junction—a little more than half that found in the run of welds; and the losses of the electrode metal during welding are upon a similar scale. The value of the quasi-arc weld under impact and alternating stresses is equal to more than 75 per cent of the strength of the plate joined by it. Other arc welds have a relative value, compared with the original plate, of upward of 30 per cent. Finally, the quasi-arc weld can be made 50 per cent more quickly and is no more expensive than competing arc-welding systems.

Fixed Stars That Are Not Fixed

(*Continued from page 390*)

Harvard procedure of superposition. And not only does it differ from the Harvard method but also from that used by Prof. J. C. Kapteyn in the measurement of parallaxes. Professor Kapteyn photographed upon one and the same plate the same field at intervals of a half or a quarter year. He then measured the intervals between images of the same points of light. Naturally, the bulk of the points showed no displacement—only those which had really moved. The stereocomparator has the advantage of *attracting* attention; only, as we have seen, it attracts the eye to too many objects. The application of the microscope to the pair of plates seen as one in apparent association with motion gives effective results in advance of those got by any of the methods of superposition and in advance of the simple stereocomparator.

The blink microscope views only one of the fields at any given instant; but the arrangements are such that there is a rapid alternation from one field to the other, back again and so on. Here is where the "blink" comes in. The shutter is so arranged that it may be rapidly operated to cut off the light from one field and simultaneously pass it from the other and to make now this, now that, the field actually before the eye. When this instrument has mounted two records of the same field that are absolutely identical, the rapid operation of the blinking device serves to produce simply the effect of seeing one record in a fixed position. The flitting from one to the other is not discerned. The same principle of physiology is invoked here as in the moving picture projection camera. An image impressed upon the eye lingers an instant. If the image is withdrawn, without visible movement, and then presented again, also without visible movement, the eye is none the wiser, provided the interval between presentations is sufficiently small. The old stimulation of the optic nerve persists and during its persistence a new stimulation is effected. In the blink apparatus, while the two photographic records are actually separated, this is not the effect on the eye. It sees both along precisely the same line of vision. Light passes from but one record at a time. The shutting off the light and the permitting it to pass fail to inform the eye that a shift of object has been made. Now, if, in the microscopic fields, which are naturally much smaller than the fields of the photographic records, one stellar image differs minutely from another, both being of the same object, the rapid alternation from one field to the other will produce a quiver, if the displacement be small, and a jump if it be large. "Small" and "large" here mean relatively to the small fields. The microscope may be shifted so as to have its field pass over that of the photographic record. In this way the whole of the latter may be examined. Of course, the displacement may, as already intimated, be too small for the power of the microscope. The usable power of a microscope depends largely upon the amount of light thrown upon or passing through the object under examination.

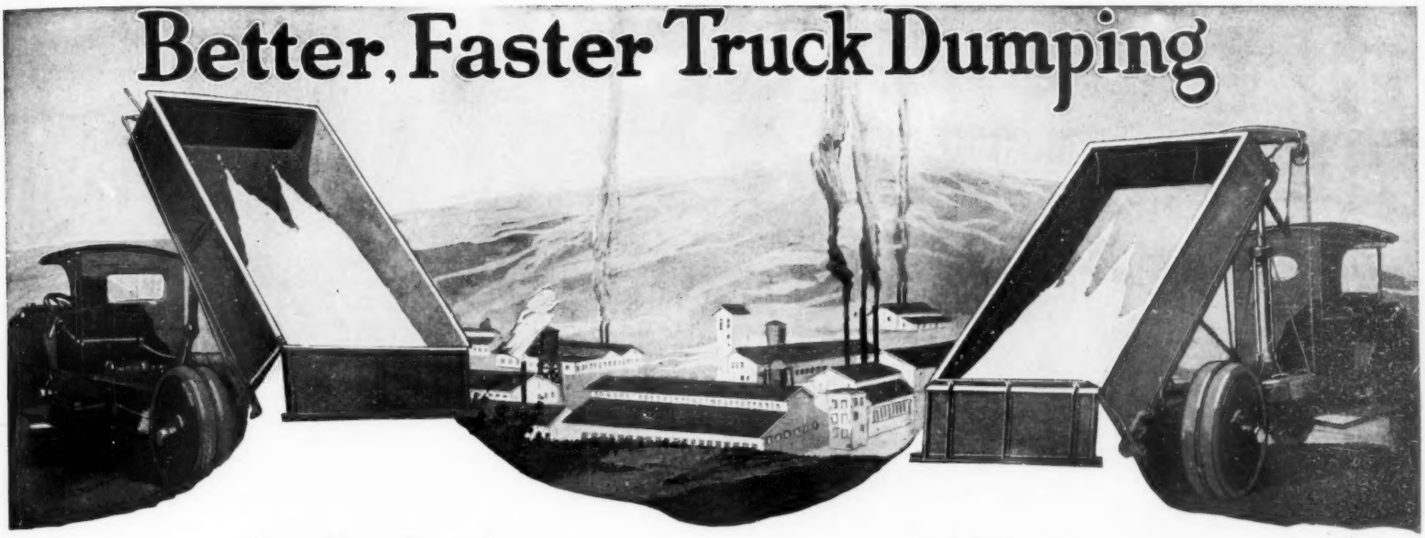
The principle of operation of the blink microscope may be understood better, perhaps, with the aid of a diagram. In the figure, P_1 and P_2 are the photographic records taken at different times. Light from P_1 is totally reflected from S_1, passes through the microscope objective Q_1, and is reflected totally again at S_1. Similarly, light from P_2 is totally reflected at S_2 and passes through the microscope objective Q_2. There are two glass prisms, P_1 and P_2, united along the surface s_2, a half-transparent silver film. The light from P_1 is *passed* through with the same intensity that the light from P_2 is *reflected*. There is no especial difficulty, it appears, in providing for identical intensities. Whether the light comes from P_1 or P_2, it passes through the microscopic field determined by the opening B and on into the ocular O.

Re-Covering the Cables of the Williamsburg Bridge

(*Continued from page 391*)

from the cables, the latter are opened up by driving half a dozen wooden wedges, placed evenly around the periphery of the cable, until they reach well into its center. The cable is then thoroughly saturated with linseed oil. The next step is to compress the mass of wires into circular form by means of a powerful circular-hinged clamp provided with a hydraulic jack, the total pressure exerted by the clamp being about thirty tons. This done, the workmen place around the cable, close up against the clamp, a ¼- by 4-inch band which is bolted in place. As soon as the band has been bolted up, the hydraulic jack is released and again applied at a point a few feet distant. These bands remain in place until the wire winding reaches them, when they are successively removed. As the winding progresses, the wrapping wire is painted—four coats being applied—successively. This completes the job. If the cables are periodically painted, there is no reason why they should not be as enduring as the pyramids. It should be mentioned that the movement of the winding machine along the cable is due to the pressure of the new wire as it is forced into place against the wire which is already in place. The work is being done under the supervision of S. Hamburger, C. E., to whom we are indebted for courtesies during the preparation of this article.

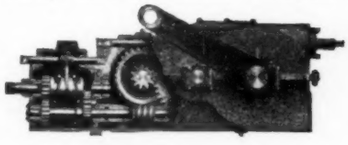
Better, Faster Truck Dumping



A 7 Ton Load Dumped in less than 30 seconds

THE VAN DORN HORIZONTAL HOIST, because of its compact location under the truck body, allows a greater ratio of body capacity to the chassis. This factor coupled with the mechanical perfection of the hoist, has caused this hoist to be adopted by leading truck manufacturers when a low body is not essential and it is desired to save the space between the cab and truck body —otherwise needed for installing a vertical hoist.

A 7 ton load can be dumped in 30 seconds. The body can be stopped, locked or lowered from any dumping angle. It stops automatically at a dumping angle of 45°. An arm and link connection maintains absolute control over the raised body at all times. There is no possibility of the body tilting suddenly under the shifting of the load. The body can be lowering as the truck is driving away, the hoist disengaging automatically as the body settles to its bed.



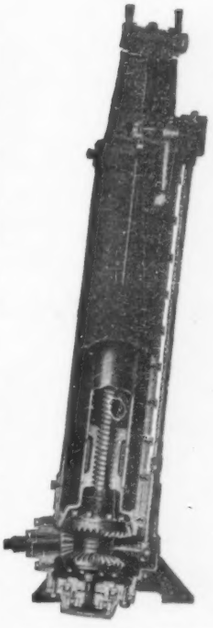
Cutaway Side View of the Van Dorn Horizontal Hoist

In the Van Dorn Horizontal Hoist the power of the motor, transmitted by gears to 1 to 350 ratio, is employed to end dump, side dump or directly elevate the truck body.

A New Idea In Vertical Hoists

THE VAN DORN VERTICAL DUMP TRUCK HOIST operated by a screw jack principle was developed as an improved power hoist to speed up load dumping and stand the rough usage of dump truck service with a minimum of operating and upkeep expense. It is built in two sizes—the "light duty" for 1 to 3 ton trucks, the "heavy duty" for 3 to 7 ton capacity.

The "Heavy Duty" Vertical easily will dump a six ton load in 20 seconds. The truck can be driving away while the body is lowering. The body can be held at any angle up to 45°, with no danger of the body lowering as the load is being dumped or scattered. Repairs on the chassis beneath the raised body can be made safely since gravity plays no part in lowering the body. It must be pulled down by the same power which raised it.



All dump truck equipment is exposed to sand, grit, water and dirt. Van Dorn Hoists are carefully designed so that all working parts are protected in oil-tight housings and castings.

Bulletin fully explaining the mechanical principle and operation of the Van Dorn Vertical and Horizontal Hoists and illustrating Van Dorn Truck Bodies will be sent on request.

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By their economical operation GMC Trucks go on and on year after year, depreciating very slowly. In the end they cost their owners far less than lower priced trucks.

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